GENERATION, TRANSMISSION AND APPLICATION OF THE POWER SERVICES

In this issue:

TRANSFORMERS

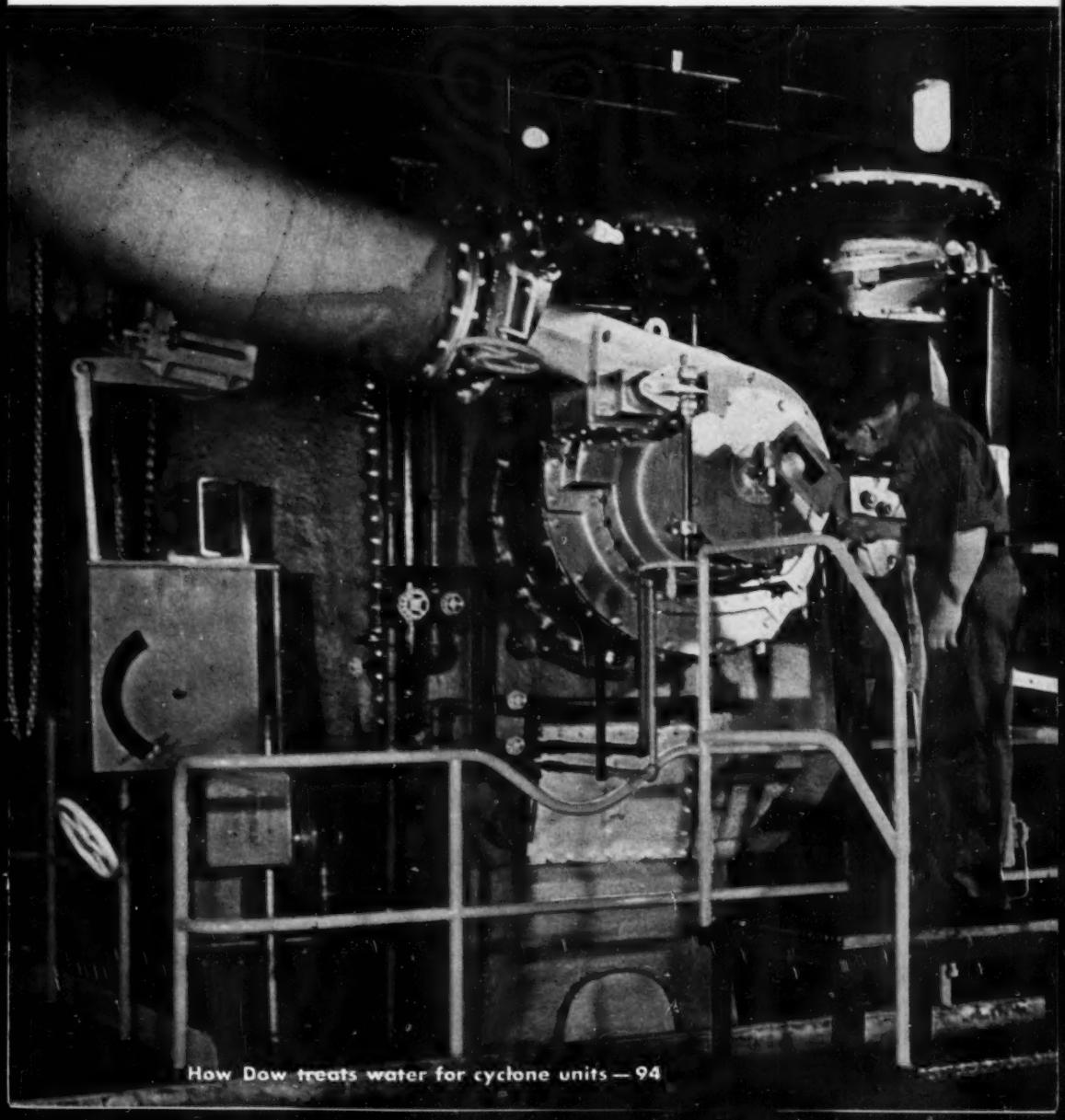
a 16-p handbook

Power

June

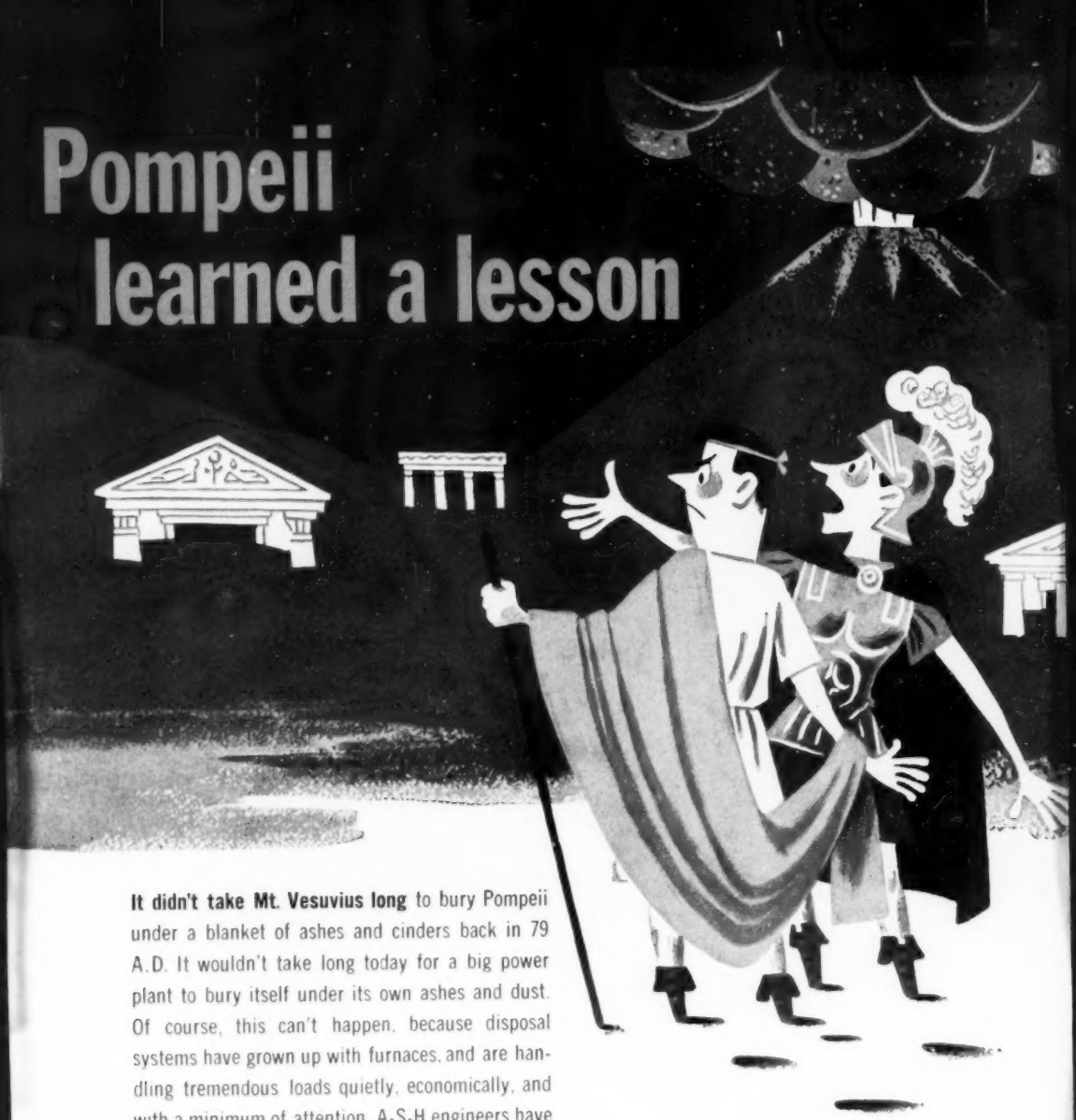
1952 · 50¢

A McGRAW-HILL PUBLICATION



How Dow treats water for cyclone units — 94

Pompeii learned a lesson



It didn't take Mt. Vesuvius long to bury Pompeii under a blanket of ashes and cinders back in 79 A.D. It wouldn't take long today for a big power plant to bury itself under its own ashes and dust. Of course, this can't happen, because disposal systems have grown up with furnaces, and are handling tremendous loads quietly, economically, and with a minimum of attention. A-S-H engineers have done much of the pioneering work that makes these results possible. Consult them on your next project.

THE ALLEN-SHERMAN-HOFF CO.
Dept. A—259 E. Lancaster Ave., Wynnewood, Pa.
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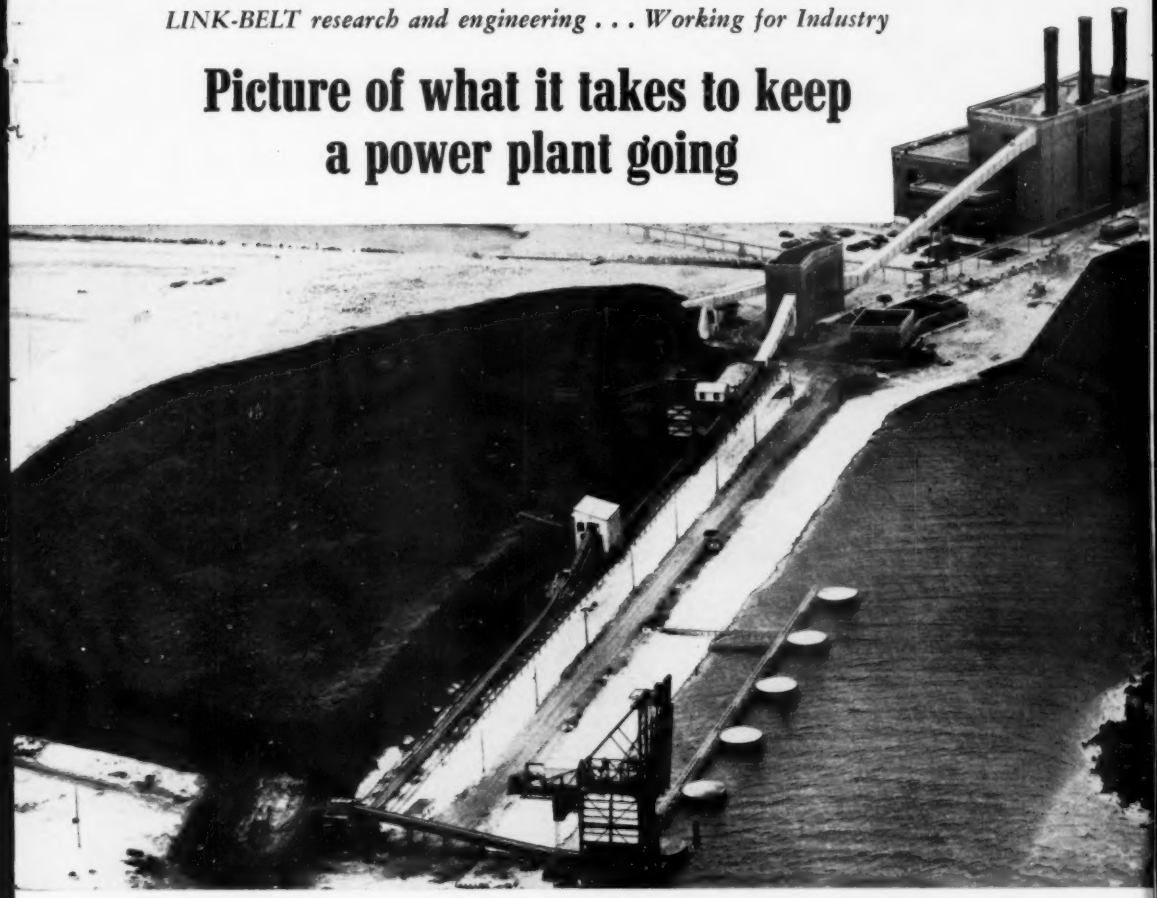
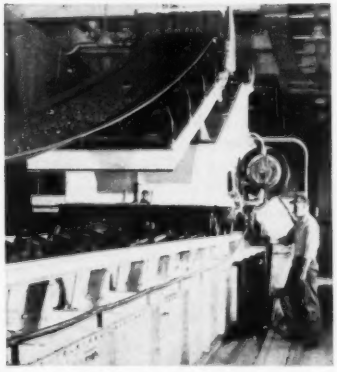
HYDROJET (hydraulic) **HYDROVAC** (pneumatic)
materials handling systems

LINK-BELT research and engineering . . . Working for Industry

Picture of what it takes to keep a power plant going





This flexible Link-Belt conveyor system at a modern generating station provides for selective handling, storage and reclaiming of coal unloaded from lake boats. Lower illustration shows belt conveyor and tripper distributing coal to bunkers.

LINK-BELT coal handling equipment plays a vital role in feeding America's hungry boilers

An efficient system of coal handling is basic in the design and economical operation of modern coal burning steam generating plants. Maximum efficiency and minimum costs are achieved only when the coal system is properly planned as an integral part of over-all plant design.

Link-Belt engineers have a vast background of experience in both large central station and smaller industrial coal handling applications. More, Link-Belt is prepared to design, furnish and erect the entire system. And from its complete line, recommend the right equipment for the job.

Link-Belt conveying and elevating equipment carries the coal from rail or dockside to storage areas and bunkers. Stackers and shovel-cranes stockpile and reclaim. Railroad car dumpers and shakers, screens, crushers and dryers perform other important functions.

And coal is just one of the basic materials conveyed and processed by Link-Belt equipment. In mine, mill or plant—wherever movement of materials is required—Link-Belt welcomes the opportunity to propose improved mechanization . . . help you reduce costs and increase output.

LINK-BELT COMPANY

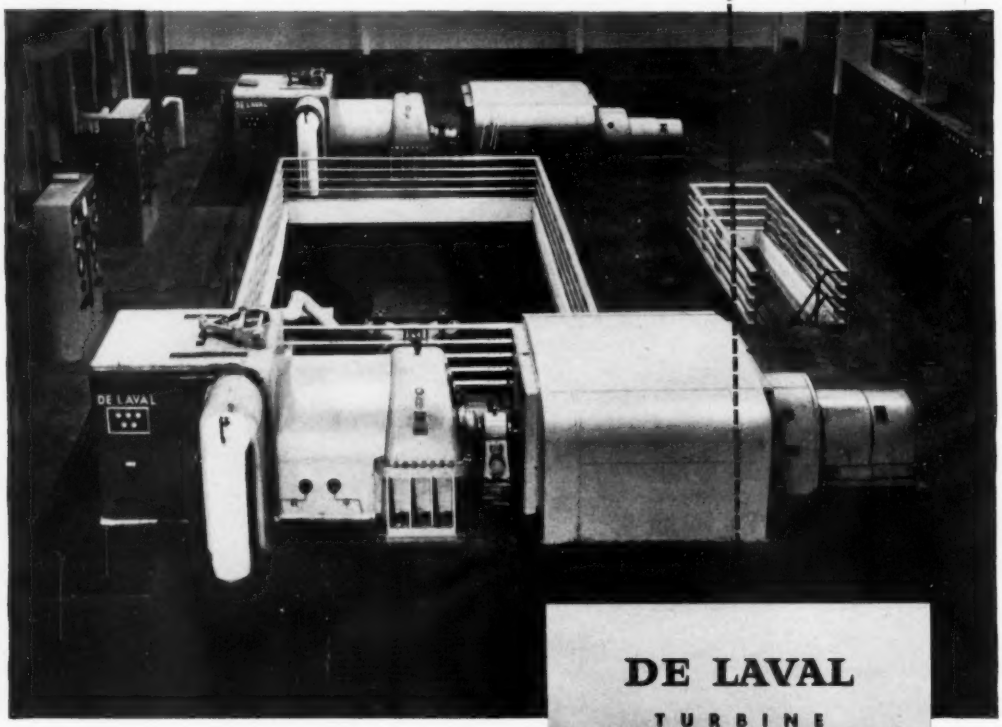
Executive Offices:
307 N. Michigan Ave., Chicago 1, Ill.
Plants: Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8, Springs (South Africa), Sydney (Australia). Offices in Principal Cities.

LINK-BELT

12,780

ONE SOURCE . . . ONE RESPONSIBILITY FOR MATERIALS HANDLING AND POWER TRANSMISSION MACHINERY

Two thoroughbreds for the blue grass country



You are looking at "13,400 horses" that will never run in the Derby. But these two 5,000 kw De Laval Turbine Generators, installed in the municipal power plant of the City of Henderson, Kentucky, add a new, dependable source of power to the famous blue grass country. Operating conditions are 600 psi at 825F and the turbines are arranged with three points of extraction for feedwater heating.

De Laval's modern Turbine Generators come from a long, pedigreed line. In fact, we have been building turbine generators for more than a half century. You can count on De Laval units to give you year-in, year-out service. Sizes range from 25 to 11,500 kw.

Be sure to send for complete data on our power plant equipment: boiler feed pumps, mechanical drive turbines, centrifugal pumps and IMO rotary oil pumps.

DE LAVAL *Turbine Generators*

DE LAVAL STEAM TURBINE COMPANY
Trenton 2, New Jersey

DL-153

Power

JUNE 1952 • VOLUME 96 NUMBER 6

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POWER articles are indexed in both the *Industrial Arts Index* and the *Engineering Index*. POWER publishes its own annual index, which is available for 50¢ from the editorial offices.

OPERATING CYCLONE FURNACES is by now a familiar experience at Dow Chemical, where their industrial application was pioneered (POWER, March 1949, pp 72-75; Aug 1950, pp 74-81). As you might expect, they've learned a lot about what it takes to get best performance. We've brought you some of this know-how in the past—now we pass along some more. This time, M E Brines reports on feedwater treatment for these high-heat-release units.

The color cover, taken in the firing aisle of the South Power House at Midland, Mich., shows the business end of a cyclone.

Next month . . .

■ A new type of POWER special section—beamed to those readers whose prime interest is operation and maintenance—makes its bow in July. It's a practical manual on selecting and using piston rings. It describes the many rings available and their uses, gives instructions for installing new rings and renewing old ones, shows how to make your own in an emergency.

■ A new short series tackles diesel and gas-engine exhaust—how to muffle and how to recover heat from it.

■ What started out to be an article on *dimetrics*, the type of drawing we introduced so successfully some time ago, has grown into a full discussion of all types of 3-dimension mechanical drawings. You'll find it full of good dope on drafting and sketching.

■ Two July articles bring you up-to-date on important phases of modern generator practice—insulation and rotor core construction.

. . . and future months

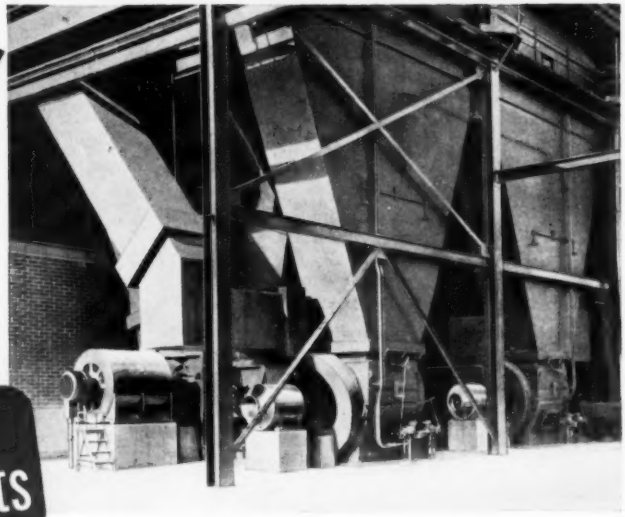
■ Back last summer POWER editors began work on an important project. The subject is *water*—where our natural supplies come from, why we face local shortages, and what's being done about them, what you can do to insure adequate supply for your plant.

We've got the facts, now we're working on the fascinating job of putting some mighty useful information into the most eye-catching and readable form. You'll see the result in September.

STEPLESS SPEED CONTROL

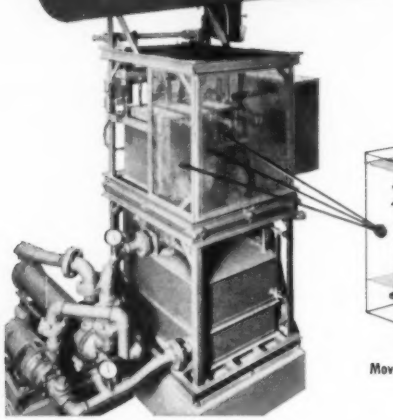
Engineered

for boiler draft fans

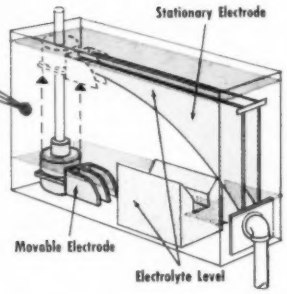


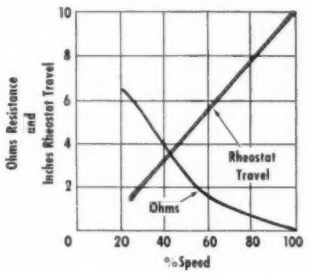
ALLIS-CHALMERS

Liquid Rheostats



FOR PROPER DRAFT CONTROL of boilers, Allis-Chalmers Liquid Rheostats are used in the secondary circuits of four 600 horsepower wound-rotor motors driving induced draft fans at the Edge Moor Station of the Delaware Power & Light Company. Direct coupling of fans and drive motors simplifies bearing alignment and maintenance problems.





TYPE 257 LIQUID RHEOSTATS can be placed in any convenient spot because only electrical connections are required. In this case, they are on the lowest floor of the power plant; the tube type TEFC drive motors are outdoors.

RHEOSTAT CELLS have both a movable electrode and a variable electrolyte level. The movable electrode is always completely immersed. Hot spots are eliminated by directing the flow of cooled electrolyte through the electrode plates.

STRAIGHT LINE SPEED CHARACTERISTICS are designed into these rheostats for each application. Needed resistance characteristics are built in by shaping the stationary electrode, and by fixing distance between electrodes.

ALLIS-CHALMERS

Allis-Chalmers Liquid Rheostats have but few moving parts . . . no arcing contacts. Electrodes can be actuated by electric, pneumatic, or hydraulic operators. Call your A-C representative or write Allis-Chalmers, Milwaukee 1, Wisconsin for leaflet 14S7544.

A-3721

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...with Power readers...

IN A FEW WORDS . . .

The article, "These Tips Will Pin Down Your Commutator Troubles," *by E A Lecher (April, pp 122-125) has created a great deal of interest among us. We have recently gone through a great deal of trouble with several of our dc motors and the above article has given us, in a few words, data that we have used.*

Hull, Canada — S SAWREY

It's always good to hear from readers who have used information in POWER to solve practical problems. But we're most pleased by the little phrase "in a few words" because we aim not only to serve up useful ideas but to put them in the least possible number of words. We want the busy reader to get his answers fast and 'apparently Reader Sawrey did.—ED.

OLDEST SUBSCRIBER? . . .

Good friend and contributor Harvey Welch says in a recent letter: "*Do you know that* POWER *is now the most complete engineering publication? I should know after reading it for about 43 years. The broad scope of information in a single issue is often worth the cost of a 3-yr subscription . . .*"

We'd just run across a number of long-time subscribers in our regular reader survey reports and Harvey's mention of his

(*Continued on page 216*)

...lines and bylines

E C Condict

SELECTING PUMPS to fit the customer's needs is Ed Condict's prime responsibility these days. In this application-engineering job with De Laval Steam Turbine Co, he sees the everyday importance of maintaining minimum safe flow in centrifugals, tells you about it on p 91.

Ed learned his fundamentals at Bucknell University (BSME, 1936), began applying them in De Laval's test department to turbines, pumps, centrifugal blowers, helical and worm gears. This valuable experience was interrupted by a 3-year Navy stint, which included machinist-mate and diving schools. Overseas duty was with the military government on Okinawa. In his last assignment there, Ed was responsible for building and maintaining roads, water systems, telephone and radio communications, rebuilding industries. Quite a chore!

O S Lieberg

"IN HOT WATER" might facetiously describe Owen Lieberg's recent activities. In his work with American Caliqua Co, consultant designers, he has specialized in application of high-pressure high-temperature hot water to industrial heating problems. You've seen some of the results of this experience; this month brings you another article of the series (p. 98).

Educated in England at Collyer's School and the Polytechnic Institute of Technology, Lieberg has been a consulting engineer in Great Britain and the U.S. for more than 20 years. Early interest in combustion and steam engineering shifted in later years to heating and ventilating. He's a member of ASH&VE, and of a number of British engineering societies—Institution of Heating and Ventilating Engineers, IEE, and IME (associate). During World War II, Lieberg was asst director of fortifications and works with the British War Dept, heading up electrical and mechanical engineering. When he finds time from his practice, he relaxes with golf and fishing.

M E Brines

WATER TREATMENT bulks large in the life of any operator. It's been more important to Ben Brines than to most because he's been tangled up in the pioneering of a number of developments in which water conditioning has had a prime place. Typical is his experience with treatment for cyclone furnaces, about which he reports in detail on pp 94-97.

Ben has been with the power dept of Dow Chemical since he graduated in 1929 from Michigan State (BSChE), with the exception of a year and a half spent with Dowell Inc. There his practical savvy in plant operation helped tremendously with their development of industrial acid cleaning. And, he kept his hand in on problems related to water.

Ben's career-long interest in water chemistry is evident in his society memberships, which include American Chemical Society (Water Division), National Association of Corrosion Engineers. He's contributed a number of papers and articles, holds a U.S. patent.

ANOTHER ADVANCE FROM B&W RESEARCH & DEVELOPMENT

Why 26 ELECTRIC UTILITIES B&W pressure-fired boilers

Higher boiler efficiency, lower auxiliary power demands, better operating control, and lower maintenance costs — these are some of the reasons why B&W's pressurized-furnace design is gaining wide acceptance by power companies. At present, 26 electric utilities throughout the country—as well as a number of industrial plants — have in service or on order B&W pressure-fired boilers serving a a total generating capacity of more than 6,000,000 kw. Comprising this total are Radiant, Open-Pass, Integral-Furnace and Stirling units having individual steam capacities ranging between 200,000 and 1,370,000 pounds per hour. Steam-drum design pressures range to 2700 psi and throttle steam temperatures to 1100 F. Fuels include gas, oil and coal—and many units are multi-fuel burning.

Already, several years of intensive operating experience stand behind B&W's pressurized-furnace design. Actual operating units fired with pulverized or crushed coal, including both slag tap and dry ash removal, serve an installed generating capacity of over 1,000,000 kw.

To effect still greater economies in power generation, pressure-firing is often used in combination with various other cost-saving features resulting from B&W's Research and Development program. These include high pressures and temperatures, divided furnaces, cyclone steam separators, gas recirculation, and Cyclone Furnace firing.

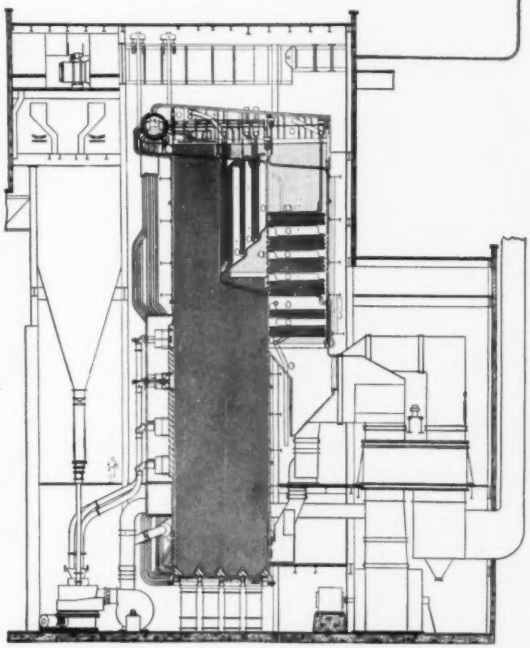
We'll be glad to talk over the details of these features in terms of your company's future requirements. The Babcock & Wilcox Company, Boiler Division, 161 E. 42nd Street, New York 17, N. Y.

BABCOCK & WILCOX

HAVE SELECTED

B&W Pressure-Fired Boilers
For a Total Generating Capacity of
Over 6,000,000 kw

Appalachian Electric Power Company • Arkansas Power & Light Company • Central Louisiana Electric Company • Central Power & Light Company (Texas) • City of Lansing, Michigan • San Antonio City Public Service Board • Commonwealth Edison Company • Consolidated Edison Company of New York, Incorporated • Dallas Power & Light Company • Houston Lighting & Power Company • Indiana & Michigan Electric Company • Jersey Central Power & Light Company • Ohio Edison Company • Ohio Power Company • Oklahoma Gas & Electric Company • Philadelphia Electric Company • Public Service Company of New Mexico • Public Service Company of Northern Illinois • Public Service Company of Oklahoma • Public Service Electric & Gas Company • Southwestern Gas & Electric Company • Texas Electric Service Company • Texas Power & Light Company • Tucson Gas, Electric Light & Power Corporation • West Texas Utilities Company • Wisconsin Power & Light Company



Pressure-Firing, Gas Recirculation, Cyclone Steam Separators, Divided Furnace and Reheat are some of the features of this B&W Radiant Boiler now under construction at a new plant of a leading eastern electric company. Rated steam capacity — 1,370,000 lb. per hr. Design pressure — 2050 psi. Pressure at superheater outlet—1850 psi. Final steam temperature—1000 F. Reheat to 1000 F.

COST-SAVING FEATURES

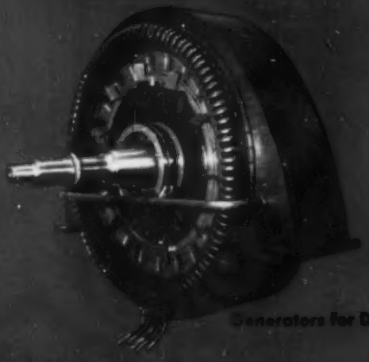
1. **Increased boiler efficiency.**
2. **Reduced fan power consumption.**
3. **Lower maintenance costs.**
4. **Greater operating reliability.**
5. **Decreased stack losses.**
6. **Simplified outlet duct and stack arrangement.**

G-552T

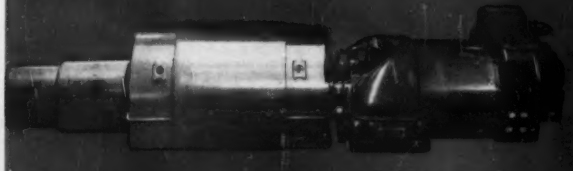
ELLIOTT
equipment for power and process

Deaerating Heaters

Condensers



Generators for Diesels



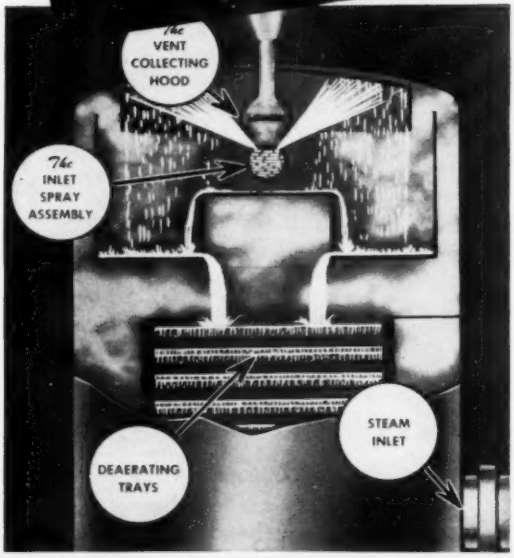
Turbine Generators

Large Motors

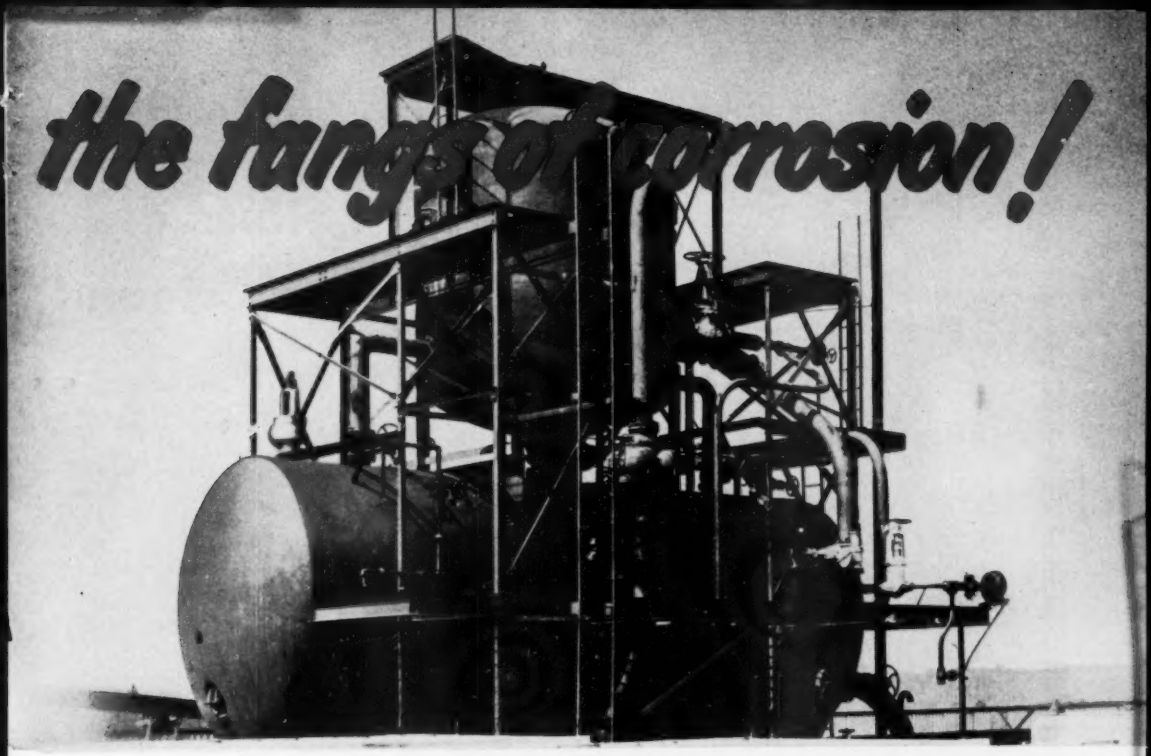
Centrifugal Blowers

They draw

ELLIOTT DEAERATING HEATERS



the fangs of corrosion!



Skyline views of most modern power plants

may show the Elliott deaerating heater mounted on its storage tank, as in the southern station pictured above. It is a symbol of liberty from the corrosive oxygen which it removes from boiler feedwater — a freedom which dates from the initial development of the deaeration principle by Elliott engineers.

This is the inlet spray unit and vent collecting hood, mounted inside the shell at the top. (See section drawing at left.)

The design of the Elliott deaerating heater of today virtually eliminates maintenance. The tubular vent condenser formerly used is replaced with an inlet spray unit and vent collecting hood that require no attention, and also cut down the unit's vertical dimension, important in limited headroom. Trays are of light stainless steel. Wherever undeaerated water contacts the metal, non-corrodible material is used.

The complete deaerating heater is built throughout in the Elliott shops. Full details are given in Bulletin N-16, mailed on request.

ELLIOTT Company

Deaerator and Heater Dept. • JEANNETTE, PA.

Plants at: JEANNETTE, PA. • RIDGWAY, PA. • AMPERE, N. J. • SPRINGFIELD, O. • NEWARK, N. J.

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Q2-2

Turbochargers for Diesels | Strainers | Steam-Jet Ejectors | Mechanical Drive Turbines | Small Integral Motors | Tube Cleaners

some boilers are harder to keep clean than a small boy . . .

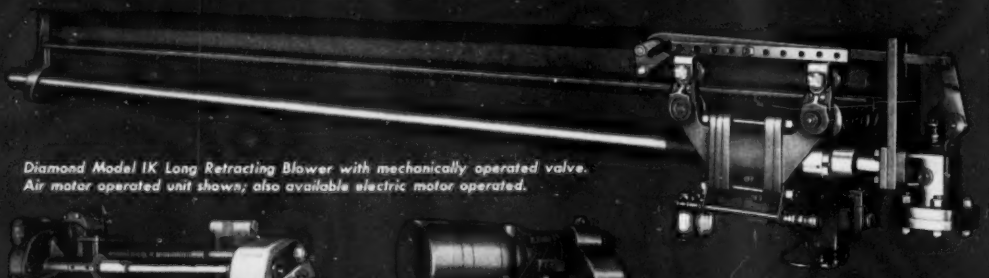
At certain ages a small boy defies all efforts to keep him clean. He has a magnetic attraction for dirt. You can scour him, dress him and threaten him, and in five minutes he looks like something out of a hobo jungle.

Some boilers are like that. Often burning inferior fuels, they are continually bathed in an atmosphere of soot and slag-forming products of combustion. Engineers nurture ulcers trying to keep such boilers clean and in good operating condition. Necessary complexities of modern high service designs do nothing to ease the job.

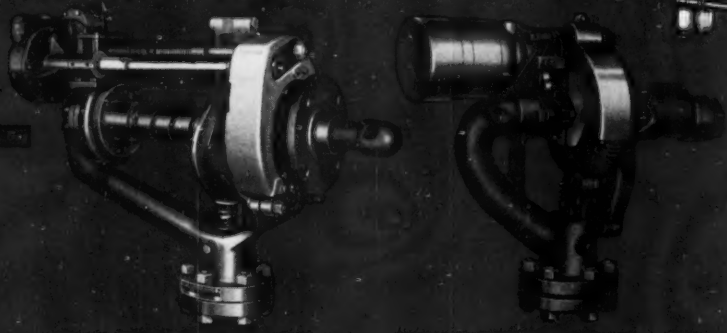
For boilers that are hard to keep clean, call upon Diamond Blowers. During our 49 years in the soot blower business, we have tackled and licked the toughest cleaning jobs. Usually we know what to do, guided by this experience. When we encounter one where we don't, we have the staff, the laboratory facilities and the understanding to find out. You can always depend upon Diamond for correct boiler cleaning at the lowest overall cost.

DIAMOND POWER SPECIALTY CORPORATION
LANCASTER, OHIO
Diamond Specialty Limited
Windsor, Ontario

DIAMOND Has the Experience and Equipment to Meet ANY Boiler Cleaning Requirement



Diamond Model IK Long Retracting Blower with mechanically operated valve. Air motor operated unit shown; also available electric motor operated.

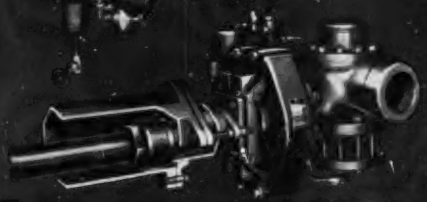


Diamond Model IR Short Retracting Blower with air motor operation; electric or manual operation also available.

Diamond Model G9B Automatic Valved Blower with electric motor operation; also available with air motor or manual operation.

Diamond Panel for automatic control of complete cleaning cycle including all types of blowers. Air operation shown; also available with electric operation.

Diamond Master Controller for automatic control of Air Puff units.



Diamond Model A2E Automatic Air Puff Blowers.

Diamond Automatic Air Heater Blower has air or electric operation . . . air or electric control.

How to the Efficiency Boiler-Room

Before you get steam you've got to spend dollars—so dollars are a form of energy.

And if your boiler-room dollars are invested in equipment that isn't working efficiently, economically, your "investment" is poor.

That's where co-ordinated controls by Bailey can help. Here's why they'll increase your "boiler-room investment efficiency":

1. **Complete Range of Equipment—fully co-ordinated.** You need never worry that a Bailey Engineer's recommendation is slanted in favor of a particular type of equipment, just because he has a limited line to sell—or that Bailey will pass the buck for efficient control; we offer *complete* boiler control systems.

2. **Engineering Service—backed by experience.** No other manufacturer of instruments and controls can offer as broad an experience, based on successful installations involving all types of combustion, flow measurement and automatic control.

3. **Direct Sales-Service—conveniently located near you.** Bailey Meter Company's sales-service engineers are located in more industrial centers than those of any other manufacturer of boiler control systems; you get prompt, experienced service with a minimum of travel time and expense.

•

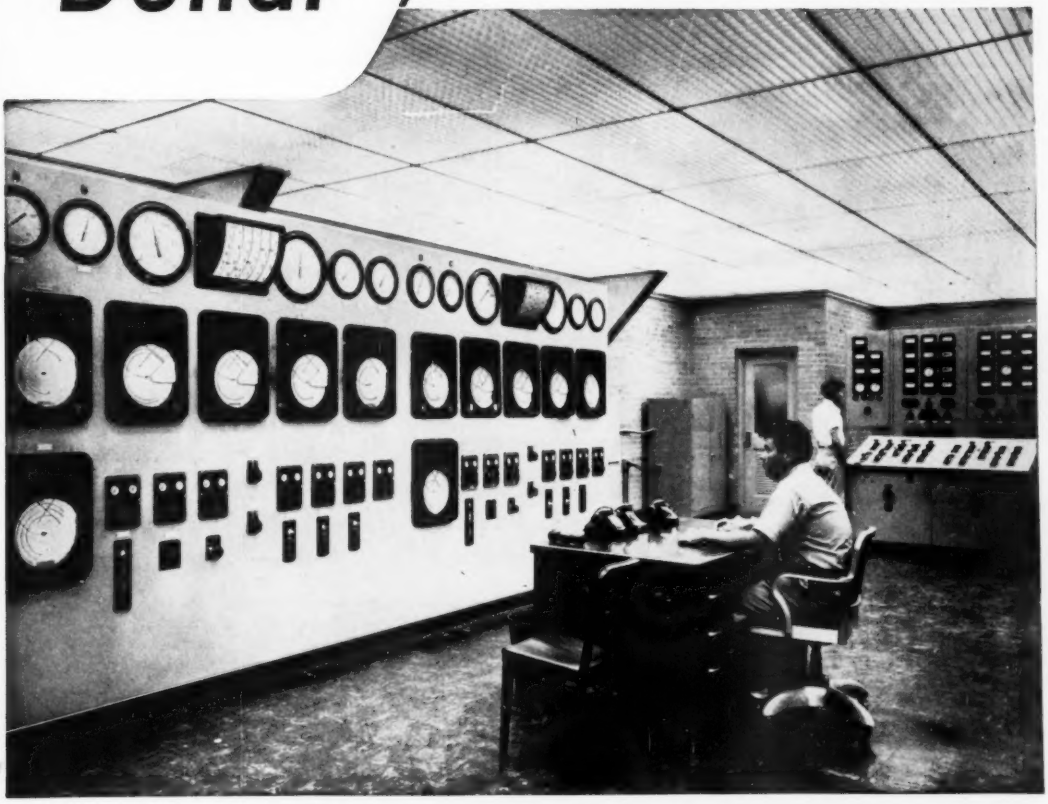
For better "boiler-room investment" efficiency—for more power per fuel dollar, less outage and safer working conditions, you owe it to yourself to investigate Bailey Controls. Ask a Bailey engineer to arrange a visit to a nearby Bailey installation. We're proud to stand on our record: "More power to you!"

111-1

Controls for Steam Plants

COMBUSTION • PRESSURE
FEED WATER • LIQUID LEVEL
TEMPERATURE • FEED PUMPS

INCREASE of YOUR Dollar



These Bailey Boiler Controls for Combustion, Feed Water, and Steam Temperature insure efficient operation of two 450,000 lb per hr, 1000 psi, 900 F, gas and oil fired boilers.

BAILEY METER COMPANY

1036 IVANHOE ROAD • CLEVELAND 10, OHIO

BAILEY METER COMPANY, LIMITED • MONTREAL, CANADA

BAILEY METERS

VULCAN *at* SOUTHWESTERN FEDERATED POWER COOPERATIVE, INC.

Boilers (2).....Springfield

Maximum Capacity.....100,000 lb per hr

Continuous Rating..90,000 lb per hr

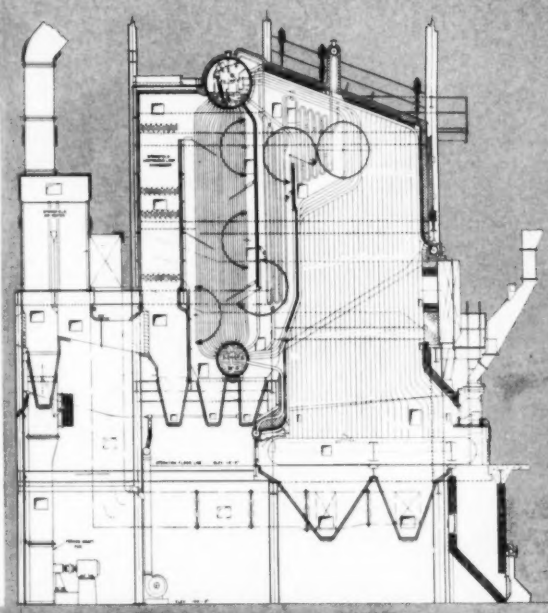
Superheater Outlet Pressure.....610 psig

Superheater Outlet Temperature.....825 F

Firing by . . . Spreader stoker or natural gas

Soot Blowing . . . Six Vulcan rotaries per boiler. One central control panel serving the two boilers is arranged for automatic or selective sequential operation of individual blowers or of the complete system for either boiler, or for remote manual operation of each blower. All air driven. Blowing medium: air.

Consulting Engineers . . . Stanley Engineering Company, Muscatine, Iowa



VULCAN *Automatic*

VULCAN *Automatic*-SEQUENTIAL CONTROL

"Out where the tall corn grows"—at the Summit Lake Generating Station the Vulcan Automatic-Sequential Soot Blower System is giving effective boiler cleaning, with modest operating and maintenance costs.

You'll get the same benefits from Vulcan Automatic Soot Blowers—whether your boilers be large or small, high pressure or low, power or process. Vulcan knows but one standard of performance—best possible boiler cleaning at the lowest possible overall cost.

VULCAN SOOT BLOWER DIVISION

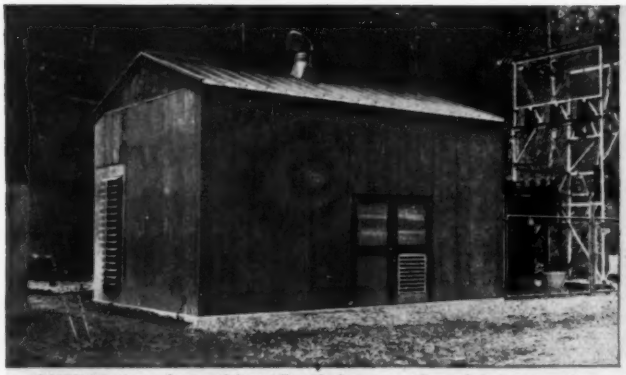
Continental Foundry & Machine Company

DU BOIS, PENNSYLVANIA

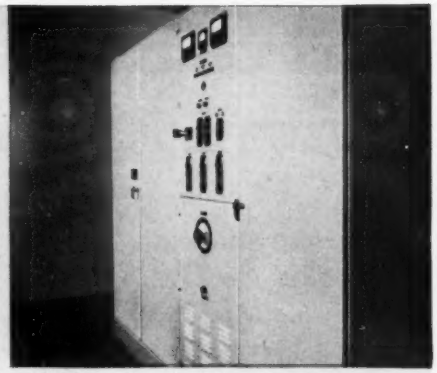
Standing at this panel, the operator controls the complete cleaning job, and sees that blowers work properly.

Whether Mine . . .

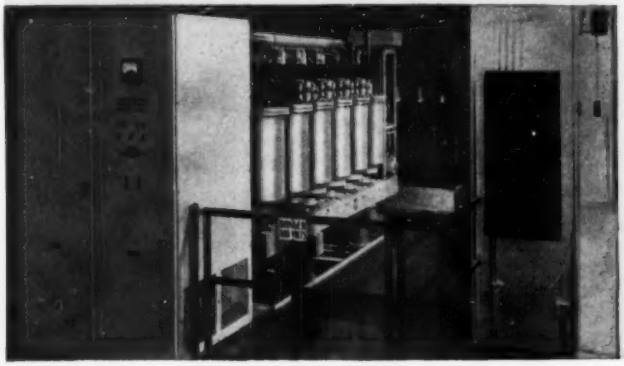
ALLIS-CHALMERS MERCURY ARC RECTIFIERS WITH EXCLUSIVE DESIGN FEATURES CAN SUPPLY YOUR DC NEEDS



OUTSIDE view of one of five Allis-Chalmers rectifier substations serving the haulage system of a coal mining operation. Transmission line enters building at right, dc leaves at left. Entire substation can be moved as coal seams are exhausted, leaving only concrete slab behind.



INSIDE is the "dead front," factory packaged, 500 kw, 275 volt dc, sealed tube rectifier. Compartments are (L to R): for rectifier tubes, firing and auxiliary control, dc cathode breaker.



PUMP evacuated rectifiers are applied in heavy duty service from 750 kw up. The 3400 kw, 500 volt unit seen here operates in parallel with steam turbine driven dc generators in the electrolytic reduction of metal.

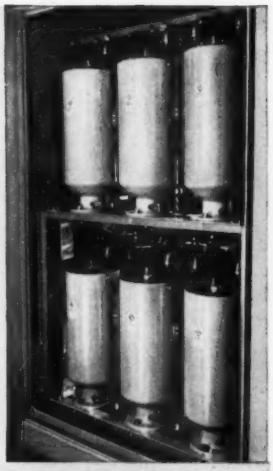
SIDE view of pump evacuated rectifier at left, showing the centralized placement of auxiliaries — exclusively Allis-Chalmers. Both evacuation equipment and heat exchanger are accessibly placed at one end.

ALLIS-CHALMERS

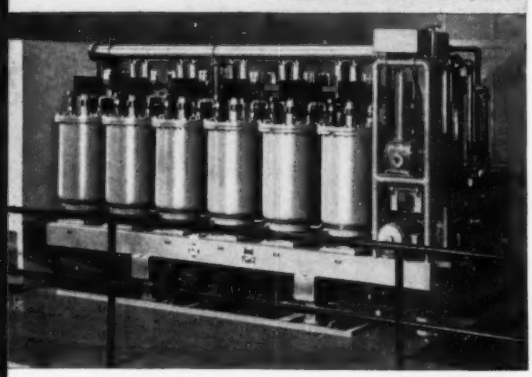
Allis-Chalmers Engineers Introduced Mercury Arc Rectifiers to U.S. Industry

. . or Mill!

ALLIS-CHALMERS MERCURY ARC RECTIFIERS



MODERN Allis-Chalmers design sealed tubes are located in the tube compartment. Other sealed tube units are supplied in ratings from 200 to 1000 kw.



WHEREVER DC IS NEEDED, from the mine to the mill, from the Elevated to the elevator, Allis-Chalmers rectifiers are quietly working away.

They combine the high efficiency, low maintenance characteristics of the mercury arc rectifier with exclusive A-C refinements in design and construction.

Factory packaged, light in weight, and requiring no special foundation, they can be placed right at the load center to cut dc feeder losses. Conversion efficiency is higher at all loads with large power savings during light load periods.

And in addition, only from Allis-Chalmers can you get rectifiers with these exclusive design refinements:

EXCLUSIVE ALLIS-CHALMERS FEATURES

- **Fixed excitation anode**—doesn't contact mercury and is independent of level, turbulence or impurities . . . requiring no adjustment, maintenance or replacement.
- **Continuous excitation** — pilot arc always present, eliminating need for continuous and synchronized re-ignition. Rectifier will ride through severe ac voltage disturbances.
- **Grid phase control**—in cooler and cleaner region near anode, where ion density is lowest.
- **Internal cooling system**—high heat transfer with seamless tube cooling coil located within the rectifier.
- **Arcover-free tank** — eliminates danger of arcing-over to tank by insulating entire arc path.
- **Enamelled anode seals** — multi-layer fused vitreous construction provides high-strength seal, unaffected by thermal variation.

All these design advances are obtainable *only* from Allis-Chalmers. When you consider mercury arc rectifiers in your expansion or modernization planning, consider Allis-Chalmers.

For help with rectifier application and a fuller explanation of exclusive superior features, call your nearest A-C office or write to Allis-Chalmers, Milwaukee 1, Wisconsin.

A-3681

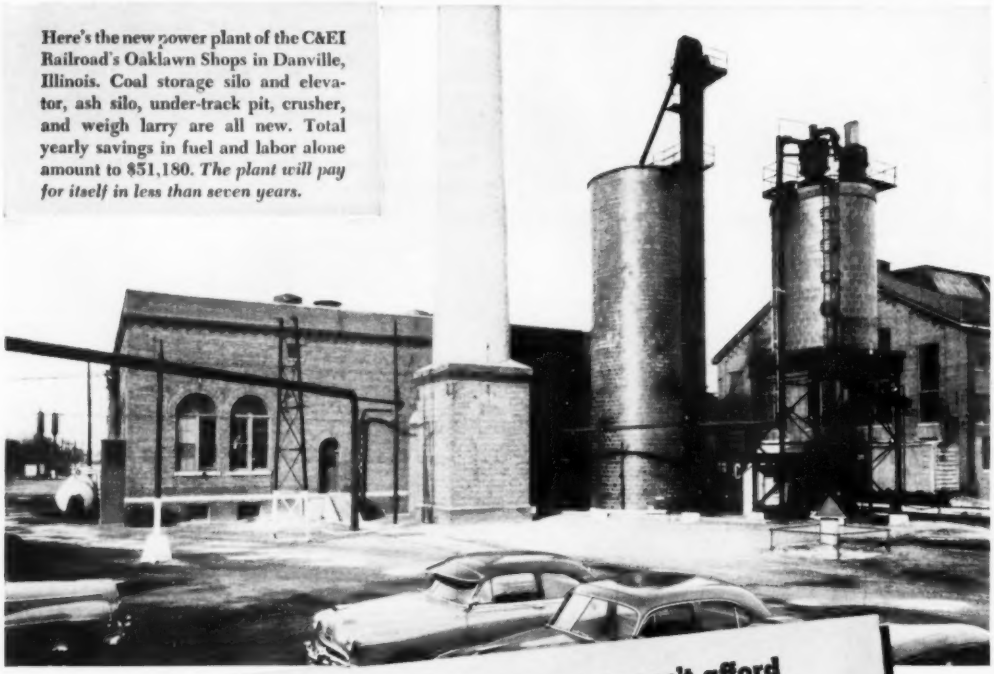
10 Mercury Arc Rectifier Advantages:-

★ Compact and light weight ★ No special foundation ★ Push button starting with no synchronizing ★ Quiet operation with high power factor ★ Low idling loss and high conversion efficiency ★ High momentary overload capacity ★ Immunity to frequent short circuits ★ No moving parts, contributing to low maintenance cost ★ No attendance needed during operation ★ Resistant to dust, moisture, fumes ★ Simple construction with long life

A-C ALLIS-CHALMERS

"BURNING COAL THE MODERN WAY CUT OUR POWER COSTS

Here's the new power plant of the C&EI Railroad's Oaklawn Shops in Danville, Illinois. Coal storage silo and elevator, ash silo, under-track pit, crusher, and weigh larry are all new. Total yearly savings in fuel and labor alone amount to $31,180. *The plant will pay for itself in less than seven years.*



If you operate a steam plant, you can't afford to ignore these facts!

COAL in most places is today's lowest-cost fuel.

COAL resources in America are adequate for all needs—for hundreds of years to come.

COAL production in the U.S.A. is highly mechanized and by far the most efficient in the world.

COAL prices will therefore remain the most stable of all fuels.

COAL is the safest fuel to store and use.

COAL is the fuel that industry counts on more and more—for with modern combustion and handling equipment, the inherent advantages of well-prepared coal net even bigger savings.

FOR HIGH EFFICIENCY
FOR LOW COST

$51,000 A YEAR!

UP-TO-DATE COAL INSTALLATION CUT FUEL CONSUMPTION 20.3% . . . LABOR FORCE 47%!"

says Mr. George E. Bennett, Supt. Motive Power, Chicago & Eastern Illinois Railroad.

"We recently modernized the power plant at our Oaklawn Shops in Danville, Illinois. Three boilers now do the work that formerly required seven. We've realized great savings in labor and fuel. It's proved to us that, when it comes to both economy and efficiency, you just can't beat *bituminous* coal burned with modern equipment."

This is a view of the firing aisle showing the spreader stokers which are fed by a weigh larry. Man-days per week required to operate the plant have been reduced from 112 to 59! The three new boilers were installed one at a time as the old units were removed, thus not interrupting the operation of the shop.

● Low cost—high dependability—easy, safe storage—coal gives you all these big advantages no matter how you burn it.

But you can get much more!

Cut labor costs to a minimum—handle coal and ashes with automatic equipment . . . burn coal in a *modern* combustion installation—you'll get more BTU's, more steam for every dollar spent.

If you're planning to modernize, or if you're building a new plant, call in a consulting engineer. He'll show you how modern coal equipment, designed to meet your specific needs, can effect a sharp reduction in your operating costs.

And remember, with coal you have a future dependability no other fuel can offer. America's coal reserves assure an abundant fuel supply far beyond the productive lifetime of your plant. And to mine this coal, America has a highly mechanized, progressive coal industry. Few American industries of any type can match the productivity and increasing efficiency of this nation's coal-mining companies. You can count on coal's economy, on coal's dependable supply—right now and for the future, too!

BITUMINOUS COAL INSTITUTE
A DEPARTMENT OF NATIONAL COAL ASSOCIATION
WASHINGTON, D. C.

YOU CAN COUNT ON COAL!

Check the three big reasons why it pays to specify Eagle-Picher Insulation:

1.

2.

3.

Eagle-Picher "66" Insulating Cement— All-purpose, rust-inhibitive, super-adhesive insulating cement. Great coverage, extreme thermal efficiency with "Springy Ball" pellets which won't collapse after application. Easy trowel application over all kinds of surfaces. Efficient up to 1800 F... reclaimable where temperatures do not exceed 1200 F.

THE EAGLE-PICHER

Cost-cutting insulations of top thermal efficiency

Insulating Cements

Fireproofing Cements

Supertemp Block

Blankets

Insulseal

Stalastic

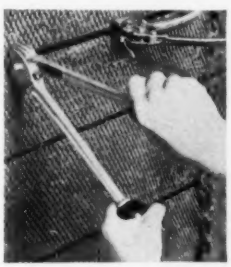
Dependable contractors, trained to strict factory standards

You can count on Eagle-Picher authorized contractors for uniformly high caliber service. Their qualifications provide assurance of a good job *every time* . . . efficient application of the Eagle-Picher insulation that best fits your needs.

Fast delivery from strategically located distribution points

The Eagle-Picher insulation line is stocked by distributors and authorized contractors coast to coast. The one nearest you will be happy to recommend insulating materials that give your equipment highest thermal efficiency . . . reduce fuel costs . . . help provide precise temperature control.

Eagle-Picher Supertemp Blocks—
A real insulating block—not a refractory! Unequalled for insulating quality. Weighs approximately 16 lbs. per cu. ft. Cuts easily with knife or saw . . . fits snugly over contoured surfaces. Monolithic structure . . . high refractory value. Withstands temperatures up to 1700 F. All standard sizes, from 3″ x 18″ to 12″ x 36″. . . in thicknesses from 1″ to 4″.

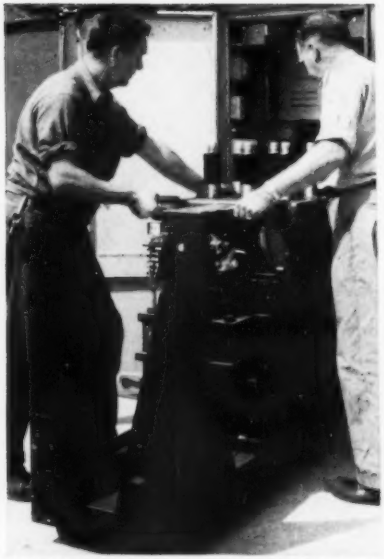


Eagle-Picher Mineral Wool Blankets—
Made under factory supervision, these blankets fill your needs for fast, convenient insulating of flat or curved surfaces on larger types of heated equipment. The wool is felted and secured by flexible metal fabric . . . possesses outstanding physical and chemical stability for maximum resistance to water, steam, corrosive fumes and vibration.

COMPANY

EAGLE EP PICHER

General offices: Cincinnati (1), Ohio
Insulation products of efficient mineral wool—for a full range of high and low temperatures. Technical data on request.



EASILY REMOVABLE CIRCUIT BREAKER facilitates inspection or replacement. This *vertical-lift* breaker cannot be moved in or out of operating position unless contacts are open.

AUTOMATIC G-E LOAD-RATIO-CONTROL unit eliminates separate voltage regulator. Control panel shown above has raise and lower push buttons, position indicator and operations counter. Some G-E LRC units have made over 1,000,000 tap changes without appreciable wear.

Utility finds quick answer to growing loads with G-E Packaged Substations

QUICK INSTALLATION: This G-E substation for the Western Massachusetts Electric Co. was trucked directly to site of installation, bolted to waiting foundation, connected to high-side and feeder cables, and placed in operation.

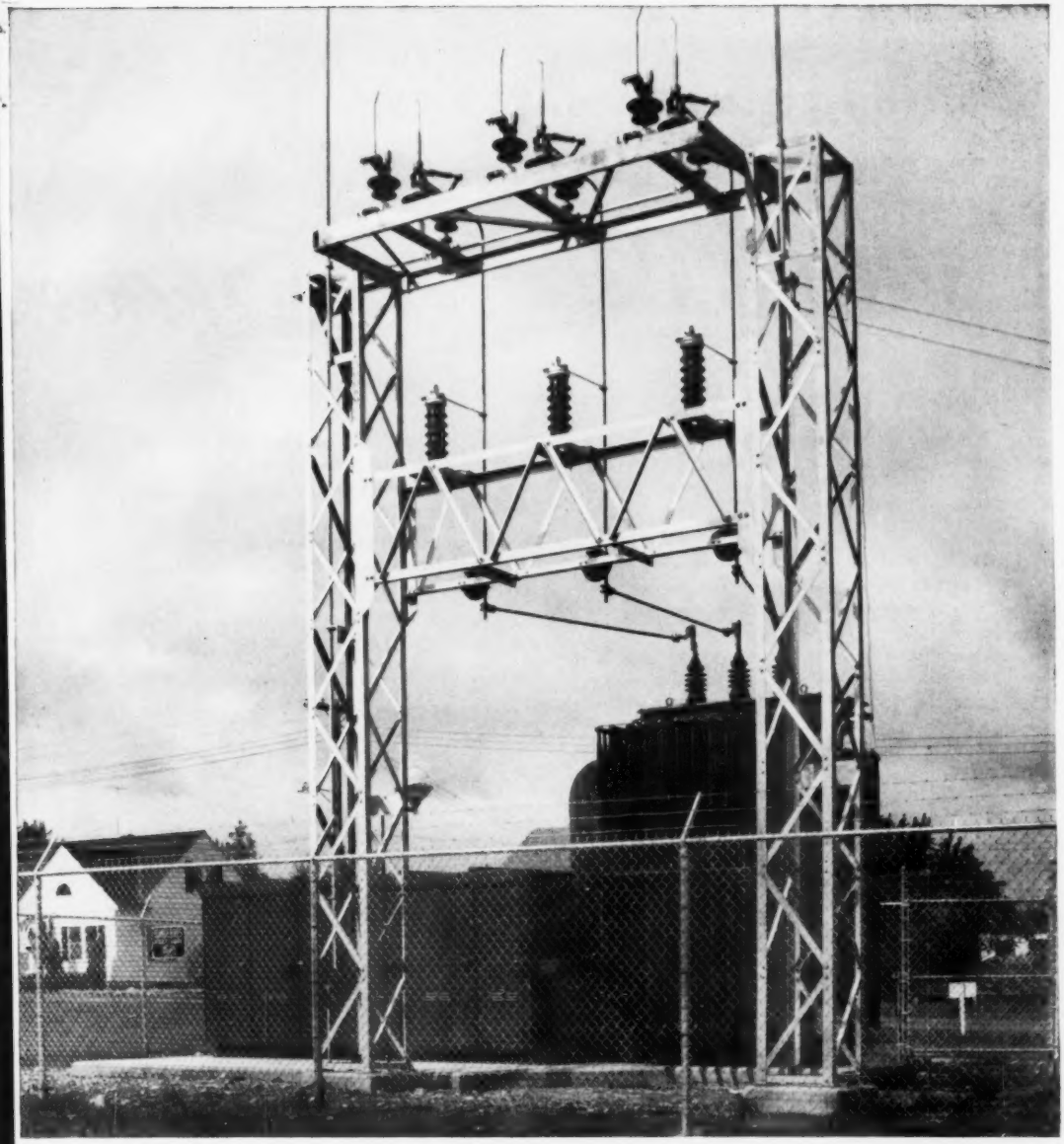
Standardized factory-assembled substations simplify utility expansion.

Faced with rapidly growing loads on one side of Pittsfield, Mass., the Western Massachusetts Electric Company found a ready answer when it ordered and installed the G-E unit substation shown at left. By selecting a standard unit directly from G-E specifications, it not only got quick delivery of a complete, ready-to-operate substation, but also saved time and money all along the line—from initial planning through to final installation.

When the need for further substation capacity developed on the opposite side of town, standardized equipment again was the answer—even to the necessary steel structure, as shown in the photograph on the opposite page.

The trend to standardized equipment, as the logical cost-saving way to meet growing loads, is evident in utility expansion programs across the country. Because of their great flexibility, G-E unit substations are applicable to a wide variety of system arrangements. For full information, write for Bulletins GEA-3800 and GEA-4500. *General Electric Co., Schenectady 5, N. Y.*

321-76



EVERYTHING STANDARD—INCLUDING THE STRUCTURE: One of the latest substations installed by the Western Massachusetts Electric Company, this unit was supplied complete, even to the steel structure for the incoming high-voltage lines. Standardized equipment like this eliminates weeks of detailed planning and engineering, simplifies purchasing. Trained engineering personnel have more time for the important work of broad system planning. The trend is to "standards"!

GENERAL ELECTRIC

WITH NEW ILLUMINATOR ON YARWAY FLAT GLASS GAGE . . .

BOILER WATER LEVEL Shines

It's light! It's bright! It's right! You see instantly the accurate boiler water level in your Yarway Flat Glass Gage because *the meniscus at water level stands out like a brilliant star* . . . thanks to the new Yarway Type "M" Illuminator.

The Type "M" Illuminator is specially-designed to give maximum brilliance to Yarway flat glass inserts, and to spot the water level over its entire traverse. The superior penetration of its blue-white light cuts through extraneous light, dust particles in the air, and deposits on the gage glasses. Effective over longer distances.

New or already-installed Yarway Flat Glass Gages may be equipped with the Illuminator. Yarway Illuminators may be installed in pairs on four-glass gages.

Get in touch with your nearest Yarway office for further details on this latest Flat Glass Gage development, or write direct to . . .

YARNALL-WARING COMPANY
100 Mermaid Avenue, Philadelphia 18, Pa.
BRANCH OFFICES IN PRINCIPAL CITIES

A COMPLETE YARWAY WATER LEVEL SYSTEM

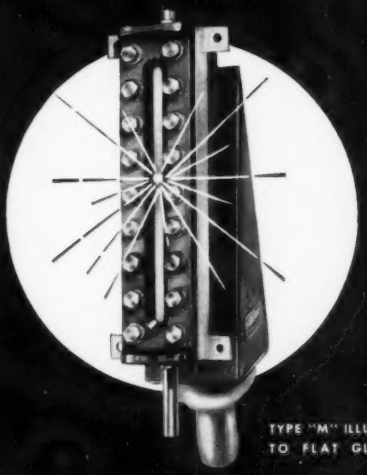
AT THE BOILER DRUM (left) Yarway Floatless Hi-Lo Alarm Water Column with Vertical Pressure-Sealed Flat Glass Gages. Equipped with Type "M" Illuminator. See Bulletin WD-1812.

ON THE INSTRUMENT PANEL (left) Yarway Remote Liquid Level Indicator, operated directly by the boiler water itself. Indicating mechanism is never under pressure—no stuffing boxes. See Bulletin WD-1822.

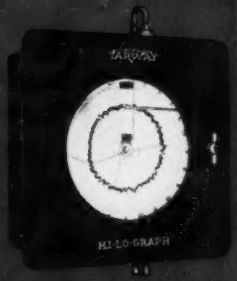
(Right) Yarway Hi-Lo Graph Recorder provides not only instant indication but also 24-hour recording of boiler water levels. See Bulletin WD-1830.

YARWAY STEAM

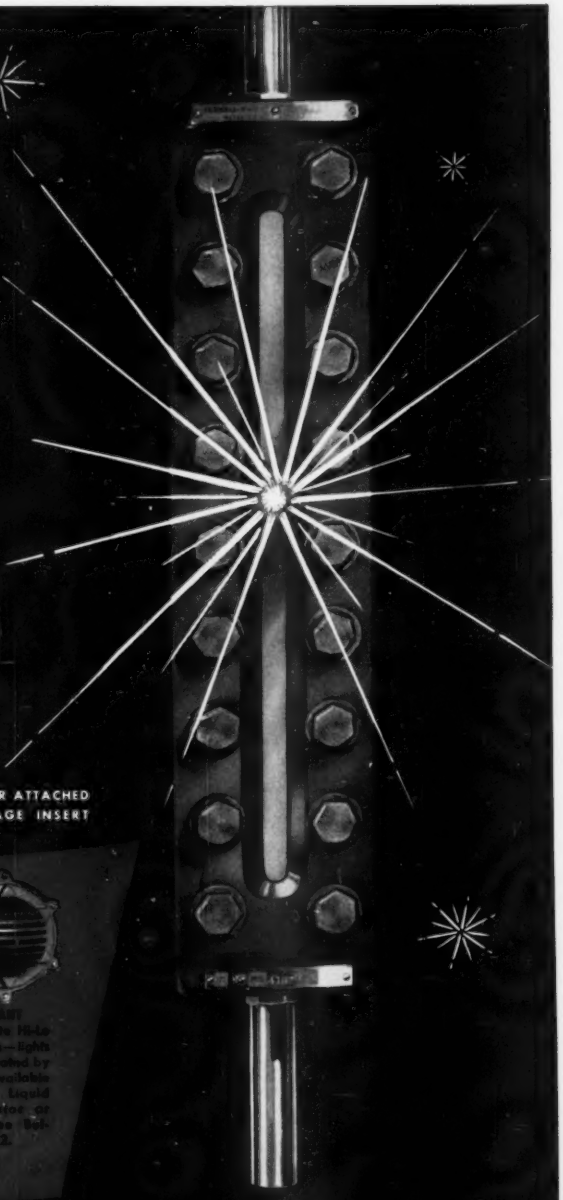
like a Star



TYPE "M" ILLUMINATOR ATTACHED TO FLAT GLASS GAGE INSERT

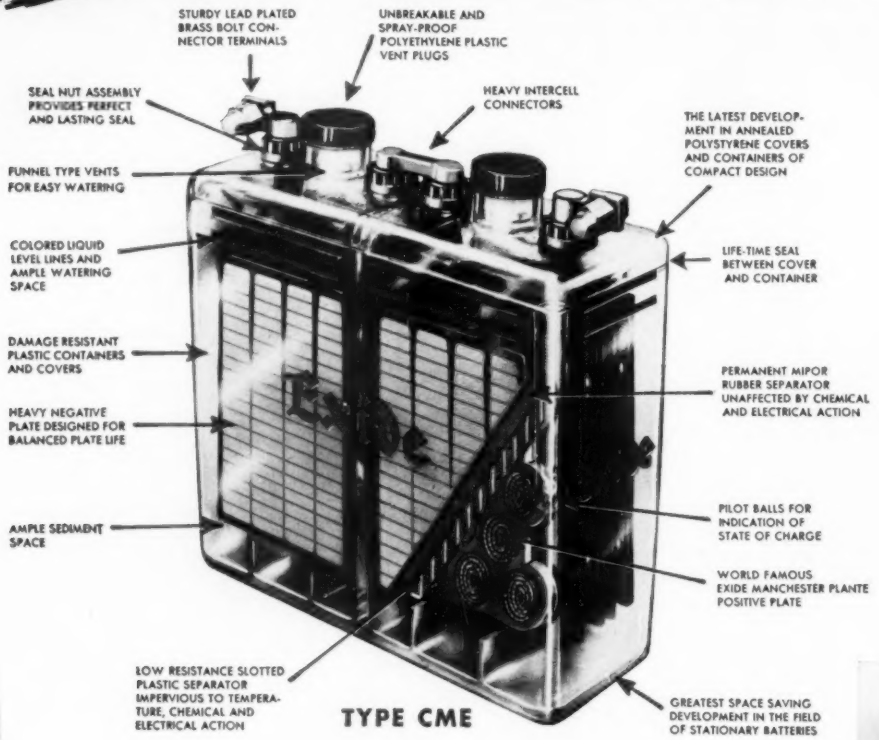


IN THE PLANT
Yarway Remote Hi-Lo Alarm Signals—lights or horns. Operated by Control Unit available with Remote Liquid Level Indicator or Recorder. See Bulletin WG-1822.



PLANT EQUIPMENT

NEW! POWER IN PLASTIC


STURDY LEAD PLATED BRASS BOLT CONNECTOR TERMINALS
UNBREAKABLE AND SPRAY-PROOF POLYETHYLENE PLASTIC VENT PLUGS
SEAL NUT ASSEMBLY PROVIDES PERFECT AND LASTING SEAL
HEAVY INTERCELL CONNECTORS
THE LATEST DEVELOPMENT IN ANNEALED POLYSTYRENE COVERS AND CONTAINERS OF COMPACT DESIGN
FUNNEL TYPE VENTS FOR EASY WATERING
COLORED LIQUID LEVEL LINES AND AMPLE WATERING SPACE
LIFE-TIME SEAL BETWEEN COVER AND CONTAINER
DAMAGE RESISTANT PLASTIC CONTAINERS AND COVERS
PERMANENT MIPOR RUBBER SEPARATOR UNAFFECTED BY CHEMICAL AND ELECTRICAL ACTION
HEAVY NEGATIVE PLATE DESIGNED FOR BALANCED PLATE LIFE
PILOT BALLS FOR INDICATION OF STATE OF CHARGE
AMPLE SEDIMENT SPACE
WORLD FAMOUS EXIDE MANCHESTER PLANTE POSITIVE PLATE
LOW RESISTANCE SLOTTED PLASTIC SEPARATOR IMPERVIOUS TO TEMPERATURE, CHEMICAL AND ELECTRICAL ACTION
GREATEST SPACE SAVING DEVELOPMENT IN THE FIELD OF STATIONARY BATTERIES

TYPE CME

DESIGNED AND ENGINEERED TO GIVE YOU...

• LONG, TROUBLE-FREE LIFE • UNSURPASSED DEPENDABILITY for the most vital applications • LOW OPERATING COST. Extremely low internal resistance and losses, hence minimum charge currents are required • LOW MAINTENANCE COST. No solutions to change, nothing to renew. Requires water only once or twice a year. Smooth, streamline design facilitates cleaning • INCREASED POWER (watt) output per unit of space • LESS WEIGHT per ampere-hour output • MORE ATTRACTIVE INSTALLATIONS • LESS SPACE REQUIRED • HIGHLY-SUSTAINED USEFUL VOLTAGE even under heavy discharge • DAMAGE RESISTANT

Exide-Manchex BATTERY

FOR ALL SMALL-POWER STATIONARY APPLICATIONS

This newest POWER IN PLASTIC is an Exide development in stationary batteries for applications requiring up to 24 ampere hours at 8-hour rate. Back of this new Exide-Manchex battery are years of research-engineering, continuous laboratory checking and prolonged field testing. Result—a battery of *exceptional ruggedness*, with *high power ability in greatly reduced space.*

ORIGINAL . . . EXCLUSIVE . . . OUTSTANDING FEATURES

PLASTIC CONTAINER AND COVER. Transparent as glass, lighter in weight, more compact and with much greater shock resistance. Container and cover are polystyrene—impervious to effects of electrolyte . . . annealed for high mechanical strength and heat resistance . . . permanent cover seal—electrolyte will not leak out. Container surface is smooth and easily kept clean.

LONG-LIFE MANCHESTER POSITIVE PLATE . . . of unique lead button construction—rolled strips of corrugated pure lead, pressed into framework of lead alloy grid. Forming action expands buttons and locks them securely in place. Only a small portion of lead is formed initially into active material . . . the remainder is available for gradual conversion in service. NEGATIVE PLATES match the long life of the positives.

DOUBLE INSULATION—Mipor separators, of microporous rubber, together with slotted polystyrene separators act as a permanent electrical insulator while permitting free diffusion of electrolyte. Both are unaffected by temperature, chemical or electrical action—they will not crack, crumble or break down in service. They provide maximum insulation with minimum resistance between plates, and assure long battery life even under severe charge-discharge conditions.

OTHER FEATURES: Elements are precision-fit and cover-suspended; separators are held in place by a bottom support of polystyrene. Adequate water space is provided; infrequent addition of water is made easy by molded-in-cover funnel filling vent . . . unbreakable and spray-proof plastic vent plugs . . . Lines on all four sides of container show recommended upper and lower electrolyte levels. Pilot balls indicate state of charge. Supplied charged and wet—or dry for prolonged storage.

SIZES AVAILABLE in three styles of containers and in capacities of 8, 16 and 24 A.H. at the 8-hour rate. Two-cell and three-cell assemblies may be combined to provide any desired voltage and to fit the available space. Other new Exide batteries are available in plastic up to 100 ampere hours capacity.

For all small-power stationary applications these new Exide-Manchex batteries, Type CME, are

YOUR BEST BATTERY BUY . . . AT ANY PRICE

For further information write:

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 2 • *Exide Batteries of Canada, Limited, Toronto*

"Exide" and "Manchex" *Reg. Trade-marks U.S. Pat. Off.*

1888 . . . DEPENDABLE BATTERIES FOR 64 YEARS . . . 1952

Look into KVS

— and you'll see

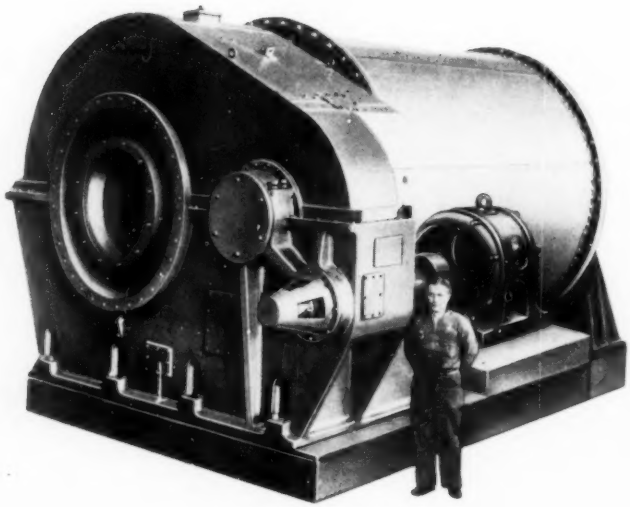
FULLY AIR SWEPT

PULVERIZES ANY COAL BITUMINOUS . . . ANTHRACITE . . . COKE BREEZE

RESERVES OF FUEL for INSTANT RESPONSE to STEAM DEMAND

LOW OPERATING and MAINTENANCE COSTS

UNBURNT CARBON LOSSES less than 1/2%



20% MOISTURE REMOVED WHILE PULVERIZING

BALLS ADDED without SHUTTING DOWN

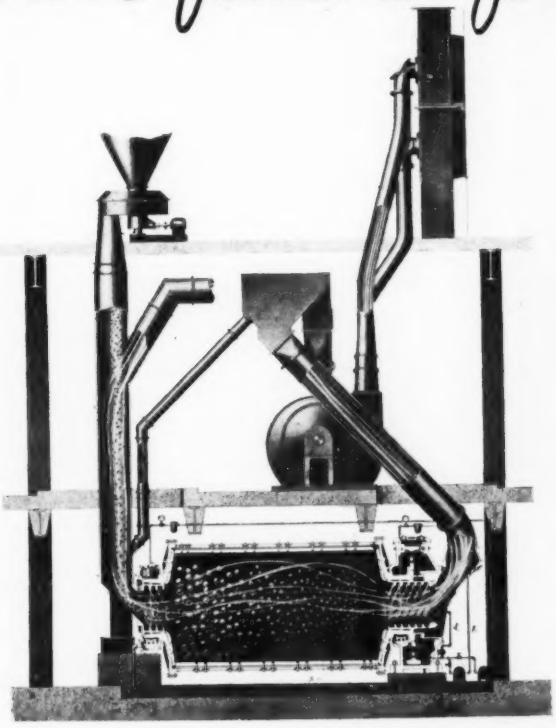
Regardless of capacity requirements, *all* of the advantages noted above are offered in KVS Air Swept Tube Mills.

Ability to prepare *any* solid fuel, completely carbureted ready for combustion, means that there are no limitations placed on coal selection. Thus it is possible to get maximum return from your fuel dollars.

The basic principle of operation of KVS Tube Mills is exclusive with KVS.

air swept TUBE MILLS

these features for yourself



INSTANT RESPONSE to CONTROLS

85%/90% THRU 200 MESH

BIG TRUNNIONS for AIR SWEEPING

TRAMP IRON actually aids in PULVERIZING

COAL PULVERIZED to SUPERFINENESS

COAL COMPLETELY CARBURETED Ready for COMBUSTION

KVS ENGINEERING SERVICE

Call on our engineers to help you decide on all steam and fuel problems. Expert planning may save you a considerabe part of your fuel bill.

Kennedy Products — Kennedy-Van Saun — Quality Service — New York, USA — Mfg. & Eng. Corp.

Kennedy-Van Saun

MANUFACTURING AND ENGINEERING CORPORATION

ARMY E NAVY

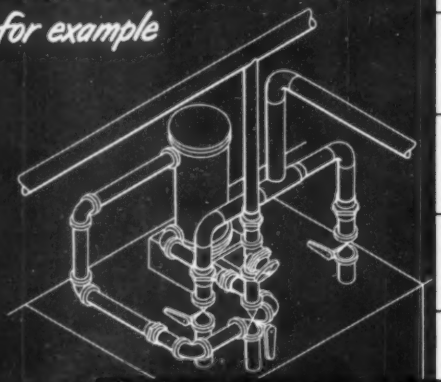
2 PARK AVENUE • NEW YORK 16, N. Y.

FACTORIES: DANVILLE, PA.

CANADA • ENGLAND • FRANCE • AUSTRALIA

Are Your Valves Behaving This Well?

...on River Water, for example



THE INSTALLATION

Crane Iron Body Diaphragm Valves on hydraulic lines to cylinder operators on ash pit gates; Southwark Station; Philadelphia Electric Company.

VALVE SERVICE RATINGS

SUITABILITY: Good design for gritty fluid

FEATURES: Neoprene disc insert-resists cutting

MAINTENANCE COST: Making big savings here

SERVICE LIFE: Already 6 to 9 times longer than other valves

CORROSION-RESISTANCE: O.K. no sign of corrosion

PRICE: Better than many ordinary valves

AVAILABILITY: Regular number in Crane line

THE HISTORY

Valves were installed in the hydraulic system when the control cocks failed to shut off tight. But like the cocks, conventional valves put in this service didn't stand up. They couldn't handle the abrasive, sandy river water used for hydraulic operators as well as for ash pit sluicing. They leaked badly in 3 to 5 weeks; had to be replaced.

The problem was solved with Crane Iron Body Diaphragm Valves. Installed more than 7 months, there's been no leakage since; no valve trouble of any kind. The Neoprene disc insert and wide, flat seating surfaces in Crane Valves show no effect of abrasion. Their completely sealed bonnet keeps working parts free of grit.

THE VALVE

In Crane Packless Iron Body Diaphragm Valves, the Neoprene diaphragm acts as bonnet seal only; is not subject to crushing and rapid wear. Separate disc with Neoprene insert shuts off flow even should diaphragm fail. Made unlined or with full Neoprene body lining. Well suited for erosive fluids, sludges, slurries; also for many corrosive services. See your Crane Catalog or call your Crane Representative.

The Complete Crane Line Meets All Valve Needs. That's Why

More Crane Valves Are Used Than Any Other Make!

CRANE VALVES

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois

Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

New Bulletin about the HAGAN RATIO TOTALIZER

This simple and versatile control mechanism, designed by Hagan Engineers, has wide application in pneumatic control circuits which include simple or complicated computing functions.

This new bulletin about the Hagan Ratio Totalizer and what it does, is yours for the asking.

for your copy, clip the coupon

HAGAN CORPORATION

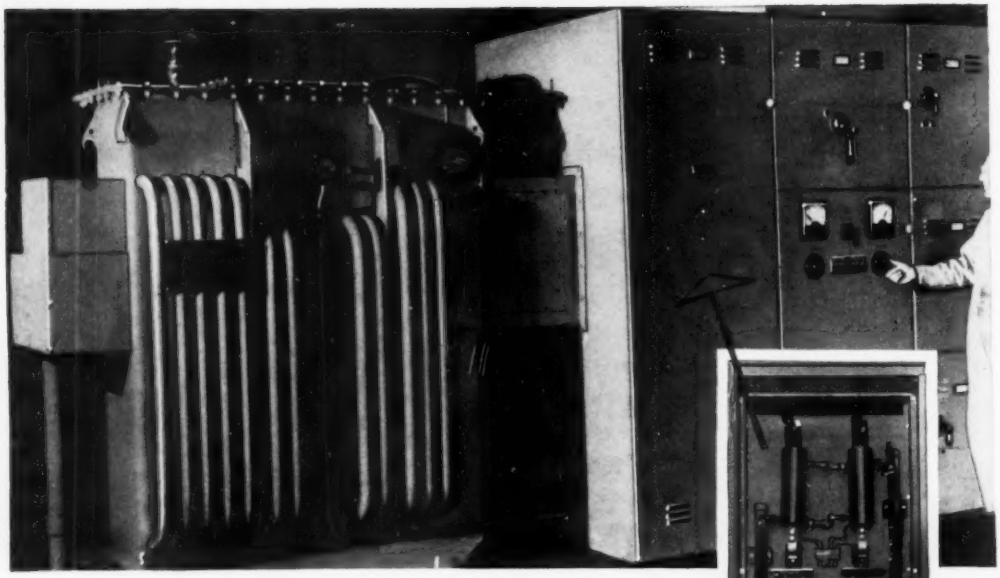
RING BALANCE FLOW AND PRESSURE INSTRUMENTS
THRUSTORQ FORCE MEASURING DEVICES
BOILER COMBUSTION CONTROL SYSTEMS
METALLURGICAL FURNACE CONTROL SYSTEMS

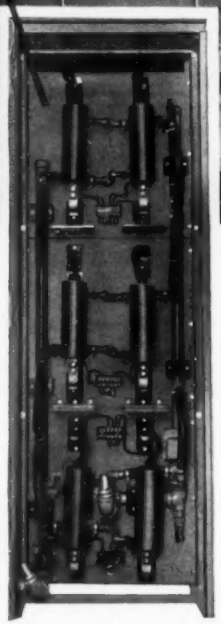
Hagan Corporation
Hagan Building
Pittsburgh 30, Pennsylvania

Please send me a copy of the new bulletin about the Hagan Ratio Totalizer

Name.....
Position.....
Company.....
Street and Number.....
City..... Zone..... State.....
P-5

Now, St. Paul Foundry & Mfg. Co. buys all its power; saves $25,000 annually!





Costly, Inefficient Steam Generating Plant Replaced by

D-C UNIT SUBSTATION

Boiler capacity for cold weather heating is all that the St. Paul (Minn.) Foundry and Mfg. Co. retains of its former steam-driven d-c generating plant. By using purchased power, the company saves $25,000 annually in fuel, operating, and maintenance costs.

Purchased power is a-c, but the plant requires d-c power for yard cranes and hoists. To tie these two systems together, a six-tube G-E sealed ignitron rectifier was installed. It operates 24 hours a day, 7 days a week.

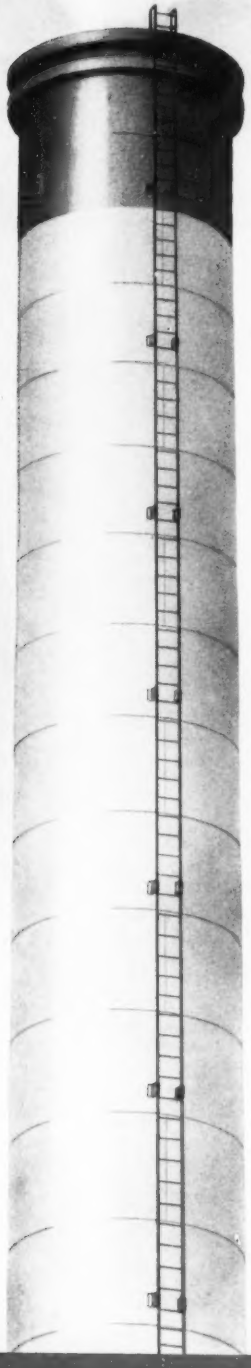
General Electric d-c unit substations with modern sealed ignitron rectifiers occupy minimum space. The transformer, rectifier and low-voltage switchgear are supplied as a complete, metal-enclosed, packaged unit. Absence of exposed, energized parts provides maximum protection to personnel. For information on d-c unit substations to fit your d-c power needs, call or write your nearest G-E sales office. General Electric Company, Schenectady 5, N. Y.

This photo shows the simple, compact design of the G-E ignitron mercury-arc rectifier unit. No major moving parts to wear out. No bearings or brushes to check. No vacuum pump required.

GENERAL ELECTRIC

324-4

American Blower . . . a time-honored name in air handling



Proved procedure for minimizing a nuisance

Important power plants all over the country have found this procedure helpful in solving their fly-ash problems. You will, too. Here's all you have to do:

1. Contact your nearest American Blower or Canadian Sirocco Branch Office. They are conveniently located throughout the United States and Canada.
2. Our competent engineers will show you (or your engineering counsel) the advantages of installing Type ST Fly Ash Precipitators to meet your specific needs.
3. Your precipitators will be completely assembled at the factory, then partially disassembled into convenient sections and shipped to your plant for installation.

PRIMARY CONCENTRATOR
BREECHING FROM BOILER OR AIR HEATER
BREECHING TO INDUCED DRAFT FAN
SECONDARY VENT FAN
SECONDARY SEPARATOR DISCHARGES THE FLY ASH TO AN AIR TIGHT RECEPTACLE OR SEALED ASH DISPOSAL SYSTEM

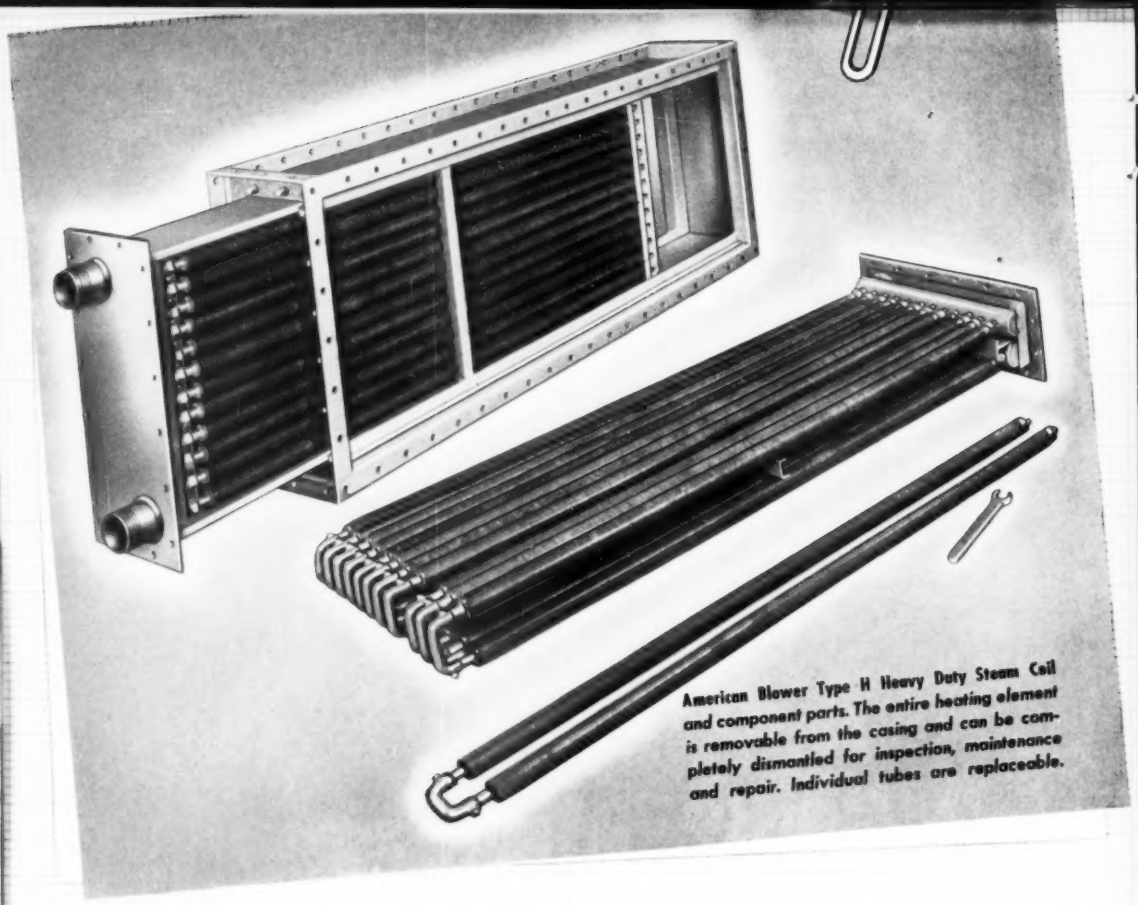
AMERICAN BLOWER

AMERICAN BLOWER CORPORATION, DETROIT 32, MICH.
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONT.

Division of American Radiator & Standard Sanitary corporation

Serving home and industry

AMERICAN-STANDARD • AMERICAN BLOWER • ACME CABINETS • CHURCH SEATS • DETROIT LUBRICATOR • KEWANEE BOILERS • ROSS HEATER • TONAWANDA IRON



American Blower Type H Heavy Duty Steam Coil and component parts. The entire heating element is removable from the casing and can be completely dismantled for inspection, maintenance and repair. Individual tubes are replaceable.

Memo to Power Plant Men —

American Blower Heavy Duty Steam Coils were developed for you for the sole purpose of providing a heating coil possessing great strength ... corrosion resistance ... ease of maintenance, and complete accessibility.

For heavy loads at high pressures, investigate them now!

AMERICAN BLOWER

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO
Division of AMERICAN RADIATOR & Standard Sanitary CORPORATION

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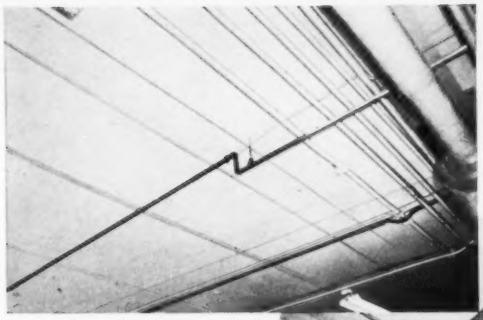
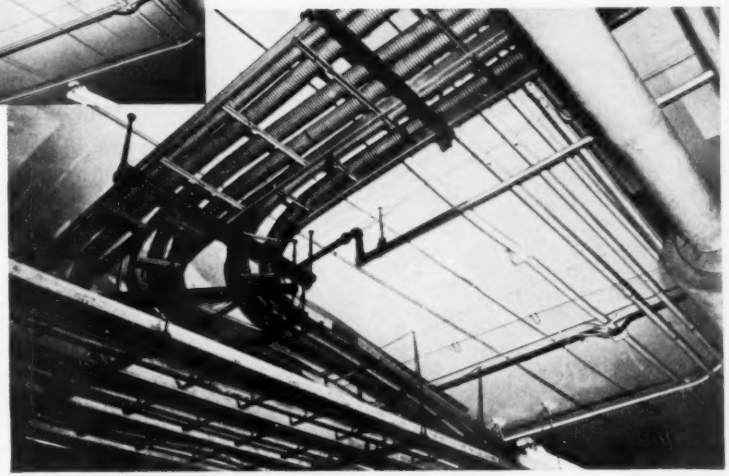


GETTING DISTRIBUTION IN FAST was the big problem in the conversion of a Midwest warehouse to a defense plant. Here the ceiling was available for wiring, but a decision had to be made on the type of wiring that would go in fast and offer the most practical results.

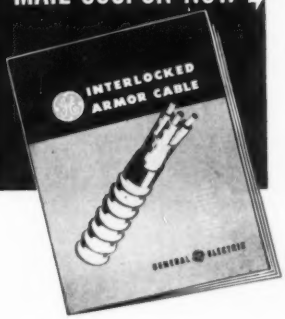


IN RECORD TIME this neat, efficient installation of G-E interlocked armor cable went into place. No detailed layout was necessary . . . cable was simply laid up on racks without need for extra protection.

Get the Facts on Installation Speed from this NEW G-E Interlocked Armor Cable Catalog

This new 20-page catalog tells you the important time-saving, cost-saving advantages of the G-E interlocked armor cable system. It offers new ideas in installation speed, explains the important benefits you get when you put up raceway and cable at the same time. Send for your copy today.

MAIL COUPON NOW



Section W23-663, Construction Materials Division,
General Electric Company, Bridgeport 2, Connecticut

Please send me your new, free catalog, "G-E Interlocked Armor Cable," Pub. No. 19-211.

Name_____ Title_____

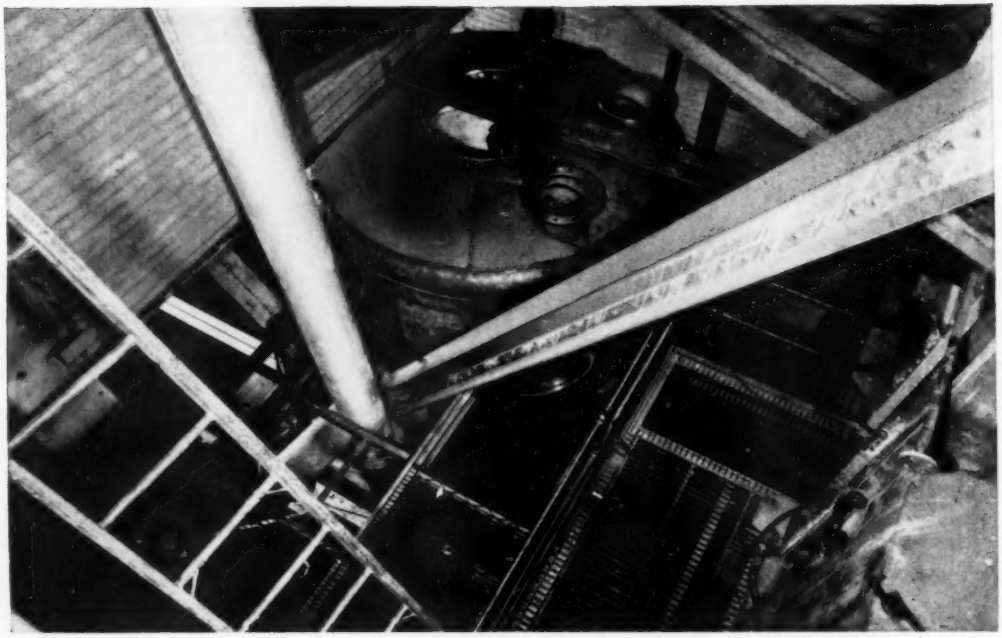
Company_____

Address_____

City_____ Zone____ State_____

You can put your confidence in—

GENERAL ELECTRIC



STAINLESS STEEL DEAERATING TANK is hoisted in place during construction of one of Detroit Edison Company's Heating Plants at Detroit, Michigan.

When CO_2 Caused a Headache ...Worthington Cured It

Detroit Edison had the solution to its problem —the problem of CO_2 in its steam—except for one thing.

Zeolite-softened municipal water used in their steam plant contains high percentages of carbonates which decompose and generate CO_2 in the boilers. Carried over with the steam into heating and processing equipment, that CO_2 could cause plenty of trouble.

The CO_2 problem was solved by Detroit Edison engineers by acid treating the softened water, converting the carbonates to CO_2. The gas thus formed is driven off in a deaerator.

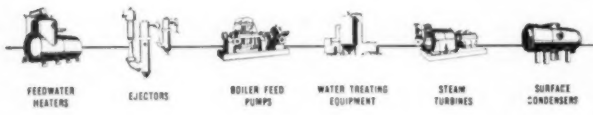
However, no standard deaerator could successfully remove the large quantities of CO_2 released by the acid treatment, and deliver water to the boiler with practically zero oxygen and zero CO_2. Furthermore, standard materials would have lasted only a few months under such conditions.

NON-CONTAMINATED STEAM

Worthington provided the answer. Detroit Edison engineers selected a Worthington deaerator specially designed for these severe conditions, built entirely of stainless steel, and guaranteed to deliver water containing not over 0.005 ppm of oxygen and not over 0.1 ppm of CO_2. The result is steam containing so little CO_2 that the amount *cannot be accurately measured!*

On problems like this one, Worthington not only furnishes *all* of the equipment needed in a complete water treating installation, but also has the engineering ability to work with your engineers on the *complete* problem of generating steam for power or processing. For further information on why *there's more worth in Worthington*, address Worthington Corporation, formerly Worthington Pump and Machinery Corporation, Steam Power Division, Harrison, New Jersey.

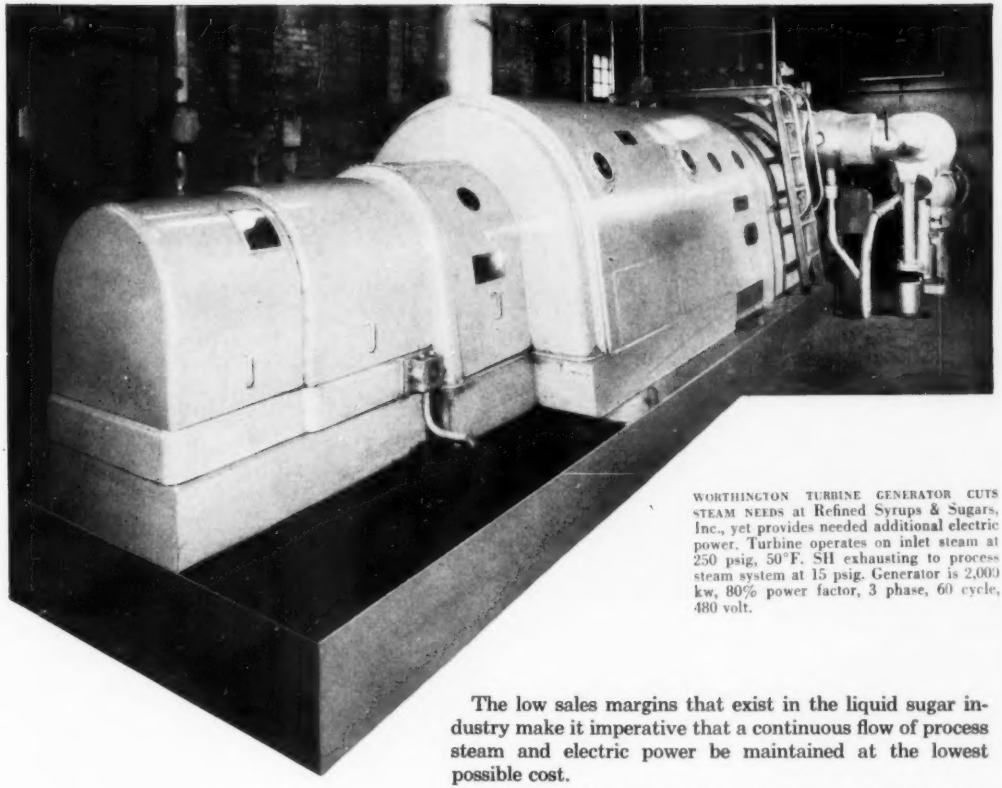
5.1.2



A GREAT TEAM IN STEAM

WORTHINGTON

Feedwater Heaters



WORTHINGTON TURBINE GENERATOR CUTS STEAM NEEDS at Refined Syrups & Sugars, Inc., yet provides needed additional electric power. Turbine operates on inlet steam at 250 psig, 50°F. SH exhausting to process steam system at 15 psig. Generator is 2,000 kw, 80% power factor, 3 phase, 60 cycle, 480 volt.

How Refined Syrups & Sugars got more kw, yet cut steam consumption per kwh by 29%

The low sales margins that exist in the liquid sugar industry make it imperative that a continuous flow of process steam and electric power be maintained at the lowest possible cost.

It was with this fact in mind, and a need for more electric power at economical rates, that Refined Syrups & Sugars of Yonkers, New York, replaced existing steam drives with electric motors and installed a modern Worthington 2,000-kw steam turbine generator.

Not only did this arrangement meet the need for added power requirements, but also reduced the amount of steam consumed in generation of power by 29% per kwh.

By going "Worthington", Refined Syrups & Sugars—like the many other Worthington users—found that unit responsibility has its rewards. Each Worthington turbine generator is designed, assembled and tested *as a complete unit* before shipment.

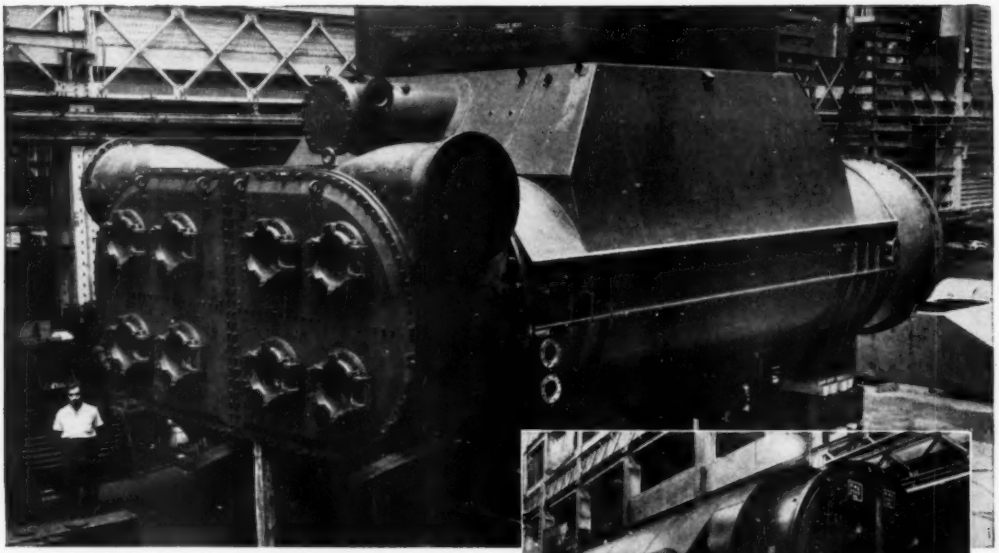
Sizes to 10,000 kw. Worthington Corporation, formerly Worthington Pump & Machinery Corporation, Steam Turbine Division, Wellsville, New York.

T.2.17

A GREAT TEAM IN STEAM

WORTHINGTON

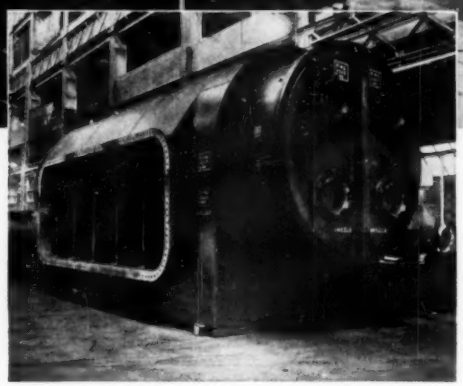
Steam Turbine Generators



LOW-HEADROOM, OVAL-TYPE CONDENSER (with extraction heater in exhaust neck), is typical of several furnished in sizes ranging from 27,500 to 80,000 sq. ft.

"TAILORED TO FIT"

Low-headroom design for condensers typical of Worthington "space" engineering



SIDE INLET CONDENSER, one-half of several "twin shell" units serving turbine-generators of 20,000 to 100,000 kw.

It all began in 1854.

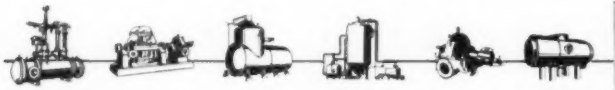
That was the year the first Worthington condenser was installed. From that time, up through the early twentieth-century "evolutionary" period in condenser design, Worthington has constantly kept in step with prime mover and steam power plant development. Today, engineers must design and build condensers within the limitations imposed by high construction costs.

Thanks to the flexible nature of the Worthington "Double Folded Tube Layer", today's "low-headroom" requirements are easily met without any sacrifice in efficiency. For single-shell, beneath-turbine installations, the rectangular box-type (built by Worthington as early as 1904) has given way to the modern "oval" design illustrated above. Other designs include single-shell, side-mounted units with exhaust elbows, and twin shells with horizontal or "T" shaped exhaust connections, popular for outdoor or semi-outdoor plants.

As the capacity of turbine-generators increases, so does the demand for larger condensers. This places more importance on "space" engineering. Worthington—with over a century of experience in the manufacture of steam power equipment—is prepared to build efficient condensers in all sizes to suit any reasonable limitations. (Now under construction for an eastern utility is the largest single-shell unit ever ordered—125,000 sq. ft.)

Write for advice on your new installation, stating requirements. Worthington Corporation, formerly Worthington Pump and Machinery Corporation, Steam Power Division, Harrison, N. J.

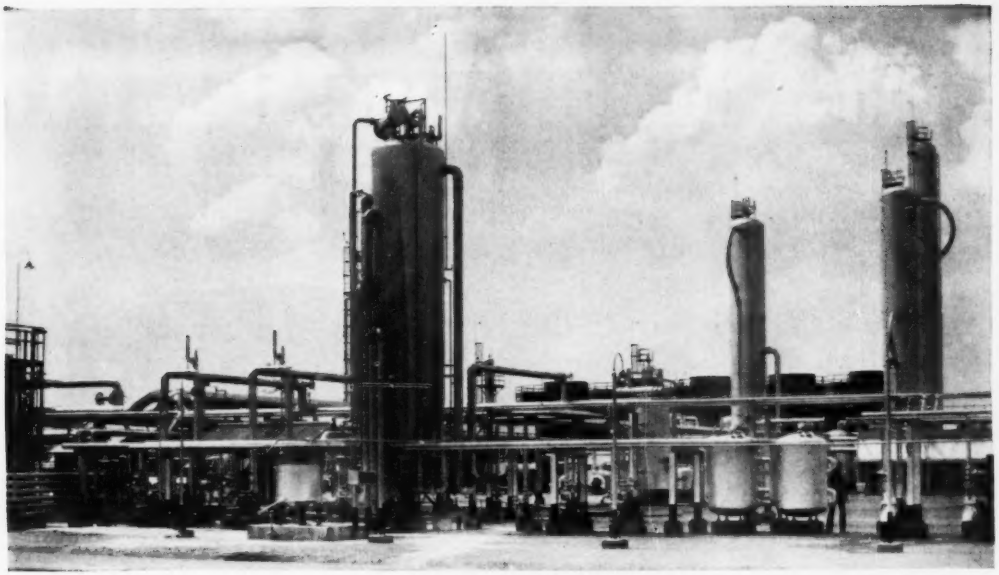
Z.2.1



A GREAT TEAM IN STEAM

WORTHINGTON

Condensers



NORTH COWDEN GASOLINE PLANT near Odessa, Texas, operated by Stanolind Oil and Gas Company. Here Worthington Water Softeners protect boilers from scale-forming deposits.

Worthington softeners protect this plant's boilers 10 ways

In this case, it's a hot-process softener to remove scale-forming deposits from boiler feedwater.

Let's examine this gasoline plant installation and see how it gives boilers "maximum" protection:

1. *Feed water is softened* by a hot-lime soda system.
2. *Selective deaeration* for operation on make up only, condensate only, or both.
3. *Non-scaling direct-contact vent condenser* heats and vents treated make-up.
4. *Tubular vent condenser vents condensate.*
5. *Oxygen contamination of feedwater avoided* by last-step deaeration.
6. *Stainless steel deaerating elements.*
7. *Uniform and efficient deaeration* during wide load swings.
8. *Filter backwashing* with clean, hot, chemically inert water without velocity change through the softening zone.
9. *Proportionate sludge removal.*
10. *Uniformly proportionate chemical feed.*

Before you buy, investigate Worthington Water Softening Systems thoroughly. Tell us the service conditions, and get our recommendations in terms of dollars and benefits. Write Worthington Corporation, formerly Worthington Pump and Machinery Corporation, Water Treating Section, Harrison, N. J.

J1.4

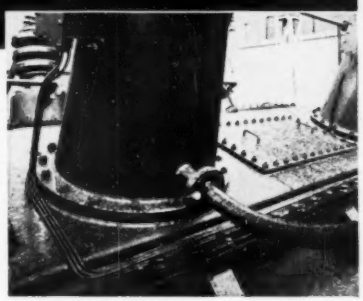
Worthington Makes More of the Equipment for ALL Types of Water Conditioning Systems

WORTHINGTON

Water Conditioning

What do you mean, it CAN

Well



Safety m.i. Wiring*
in exposed installation
on outdoor
transformer bank.

SAFETY
MINERAL m.i. INSULATED
WIRING
PYROTENAX *
A GENERAL CABLE PRODUCT

*Exclusively a General Cable Product.

TAKE ABUSE?

SAFETY m.i. WIRING

can be hammered, crushed, bent, twisted, jerked —with no impairment of its electrical performance.

Emergency overloads can't hurt it. Age causes no deterioration. It will outlast the structure in which it is installed!

and... **ONE STEP INSTALLATION!**

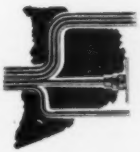
No additional mechanical protection required. Safety m.i. Wiring is its own conduit. Available fittings permit installation in one operation, using standard switch and standard junction boxes. Smaller diameter provides reserve space and assures neat appearance...

and... **NO VAPOR PASSAGE!**

Completely filled with compacted mineral insulation. Necessity for specially installed seals in the cable-run to prevent the passage of combustible gases through a wiring system is wholly unnecessary with Safety m.i. Wiring...

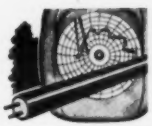
and... **COMPLETELY MOISTURE PROOF!**

Simple fittings permanently seal both ends of each run of wiring. No possible entrance for moisture. Normal concern over this hazard is thereby completely eliminated...



and... **RIGID YET FLEXIBLE!**

Thumb-pressure bending, in ordinary sizes, easily fashions orderly wall patterns—conforms wiring to any contour. Once formed, and fastened with standard clamps or straps, it stays put...



and... **NO HEAT DETERIORATION!**

The mineral insulation is physically stable up to 2800° C., thereby assuring against deterioration by heat, even beyond the melting point (1083° C.) of the copper sheath.

Your General Cable representative is well qualified to discuss the important advantages New Safety m.i. Wiring offers to all industry—for all applications from 0-600 volts. Contact the nearest General Cable office.

GENERAL CABLE
CORPORATION

EXECUTIVE OFFICES: 420 LEXINGTON AVENUE, NEW YORK 17, NEW YORK SALES OFFICES IN PRINCIPAL CITIES OF THE UNITED STATES

"More Power to You"®

Industries served by VU Boilers

Aircraft
Asphalt
Automobile
Breweries
Building Materials
Carpet
Cellophane
Cement
Chemical
Coal Mining
Coke
Cold Storage
Dairy
Department Stores
Distilling
Explosives
Electrical Equipment
Electric Power
Food Products
Foundries
Gas Works
Gelatine
Glass
Hosiery
Knitting Mills
Institutions
Laundries
Leather
Linoleum
Locomotive
Lumber
Machinery
Metal Producing
Mining
Municipal
Oil Refining
Paint
Paper
Public Utilities
Radio
Railways
Refrigeration
Rubber
Schools
Sewage Plants
Shipbuilding
Sugar
Textile
Tobacco
U. S. Government

Leaders in every Industry chooseVU

Typical Leaders in the Textile Field that have purchased C-E Vertical-Unit Boilers for one or more mills

American Thread Company
American Viscose Company
American Woolen Company, Inc.
Bancroft & Sons Company
Bigelow-Sanford Carpet Company
Burlington Mills Corp.
Cannon Mills Company
Celanese Corporation of America
Cone Mill Corp.
Congoleum-Nairn, Inc.
Dan River Mills
Goodall-Sanford, Inc.
Mohawk Carpet Mills, Inc.
Standard-Coosa-Thatcher Company
Textron, Inc.
West Point Manufacturing Company

COMBUSTION ENGINEERING

ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS

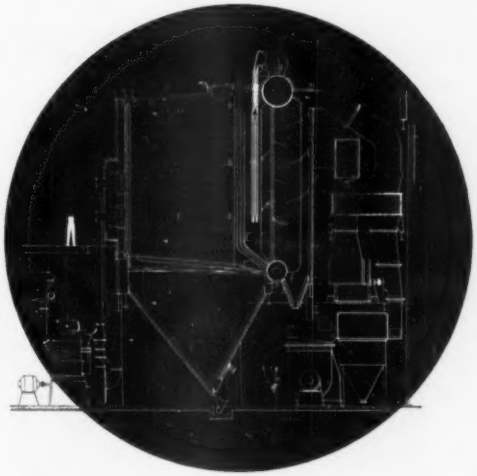
More and more . . . in industry after industry . . . you will find C-E Vertical-Unit Boilers (Type VU) establishing the standards for efficient steam production.

In ***Textile Mills,*** for example . . . where steam must be reliably available for process work . . . many of the industry's leaders, as evidenced by the representative list opposite, are users of Type VU Boilers.

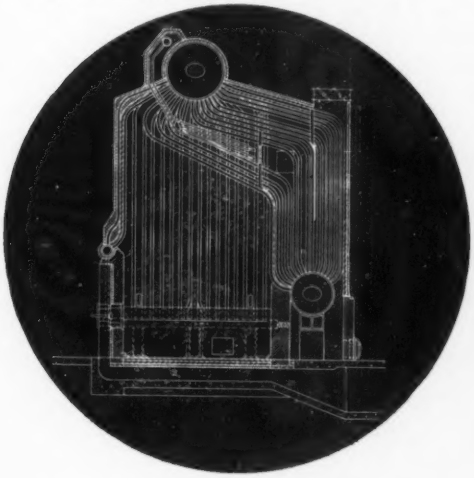
Why list only large companies when VU Boilers are also used by many smaller textile mills? Because such names form a significant guide for a prospective boiler buyer, in the same sense that the buying decisions made by operators of large truck fleets can be a reliable guide for the man who wants to buy a single truck. Moreover big companies buy boilers frequently . . . therefore their experience is always up to date. And they buy them for plants in many locations, using many different fuels. Thus they have the breadth of experience that is required for making the soundest equipment selections.

So if you need steam – from 10,000 to 300,000 pounds per hour – remember that leading companies in every industry are profiting from the advanced design . . . sound construction . . . reliability . . . of C-E Vertical-Unit Boilers.

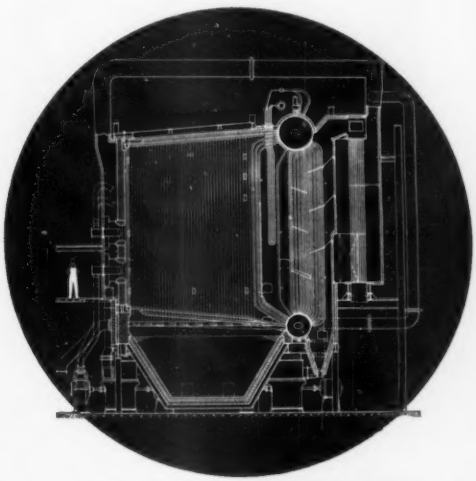
VU-50 Boiler fired with pulverized coal supplied by C-E Raymond Bowl Mills. Capacity—150,000 lb of steam per hr; steam pressure, 600 psi—temperature, 700 F.



VU-10 Boiler fired with oil or gas. Capacity of this unit is 40,000 lb of steam per hr at 420 psi and 600 F. VU-10 capacities range from 10,000 to 60,000 lb of steam per hr. They may also be fired by spreader, underfeed or traveling grate stokers.



VU-50 Boiler fired either with pulverized coal using C-E Raymond Bowl Mills, or oil as an alternate fuel. Capacity is 100,000 lb of steam per hr. Steam pressure is 200 psi; steam temperature is 500 F.



B-572

— SUPERHEATER, INC.
200 MADISON AVENUE, NEW YORK 16, N. Y.

C-E

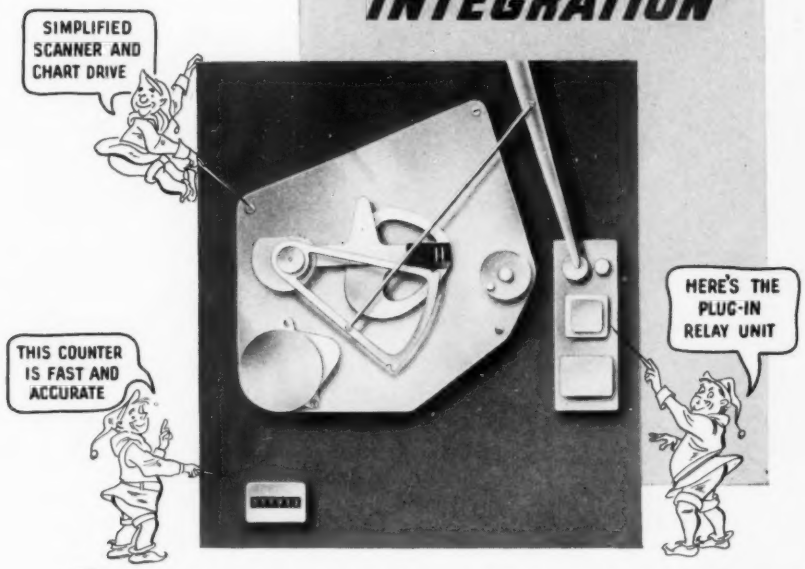
Important Contribution to

The

Brown Electric Flow Meter

EVENLY DIVIDED CHART... provides uniform accuracy for all rates of flow. Write for *Catalog No. 293-1.*

incorporates . . . ELECTRONIC INTEGRATION



Two important features...evenly divided chart and electronic integration... facilitate flow cost accounting; eliminate intermittent measurement and slow, complicated totalizing.

The electronic integrator, consisting of but three major parts, simplifies accessibility and maintenance . . . permits quick checking and calibration. Scanning is rapid and extremely simple. The corrosion resistant meter body is of tubular construction, reducing weight and bulk. Transmission is electric. Mechanical flow meters, evenly graduated and similar to that shown, but with the bell directly coupled to the recorder pen are also available. Recorder is fast, chart is easily read under all conditions of flow. The characterized bell is corrosion resistant, too, and is specially designed to eliminate tilting.

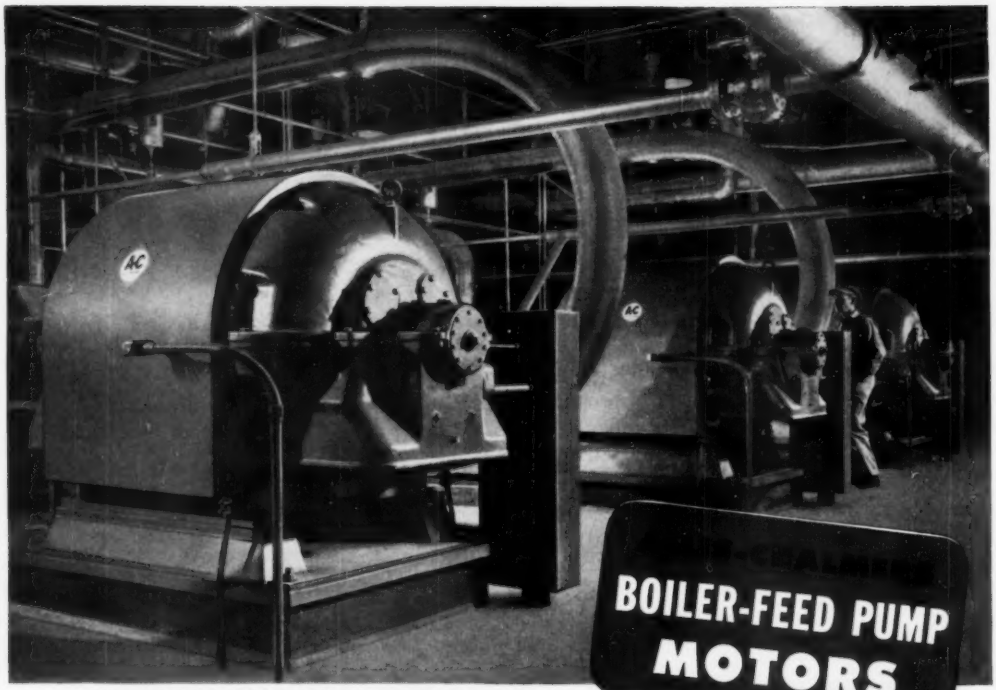
Call in our local engineering representative for a discussion of your application.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 4490 Wayne Ave., Philadelphia 44, Pa.

MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS
First in Controls

● *Important Reference Data*

Write for a copy of Catalog No. 293-1, "Evenly Graduated Flow Meters" . . . and Bulletin No. 90-2, "Supervisory Instruments for Power Generation."



Three Allis-Chalmers 1500-hp, 3580-rpm cage motors driving pumps in Alabama Power Company's Gorgas Steam Plant.

Give Extra Protection TWO WAYS!

BECAUSE LOSS OF FEEDWATER can lead to extensive boiler damage, it is common practice to provide protection by means of a standby boiler-feed pump unit. It is equally good practice to insist on the additional protection of the operation-proved reliability of Allis-Chalmers motors.

YOU GET THESE FEATURES

As the result of a quarter century of development, A-C two-pole cage motors offer you these features:

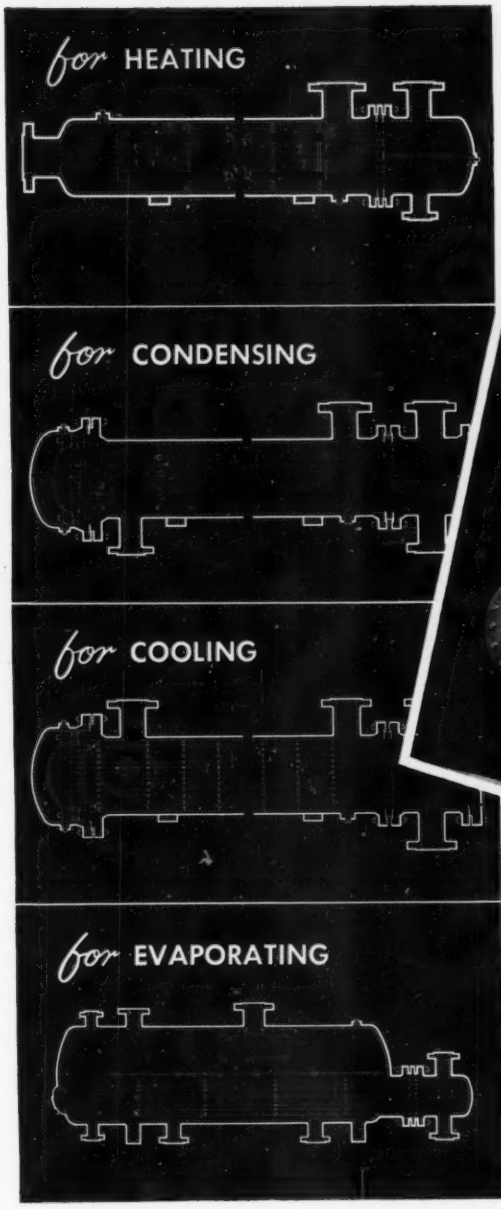
- Ring-oiling adequate for prolonged emergency operation without forced-feed oiling.
- Equalizing air pressure chambers to positively keep oil out of motor windings.
- Air distribution arrangement that eliminates hot spots in both stator and rotor.
- Forged end rings, drilled for cage bars.
- *Dew-drop* bars that give better performance and stay tight in rotor core.
- Oxygen-free copper or deoxidized copper-base alloy bars and end rings to eliminate embrittlement from silver-brazing.
- Separate steel balancing rings for dynamic balancing without weakening end rings.

BULLETIN TELLS THE INSIDE STORY

For more details about these large two-pole cage motors, ask your nearby A-C representative for Bulletin 05B7550, or write to Allis-Chalmers, Milwaukee 1, Wisconsin.

A-3719

ALLIS-CHALMERS



Whether you use heat exchangers for heating, cooling, evaporating or condensing, you'll find help in this informative bulletin describing SUPERIOR Heat Exchangers.

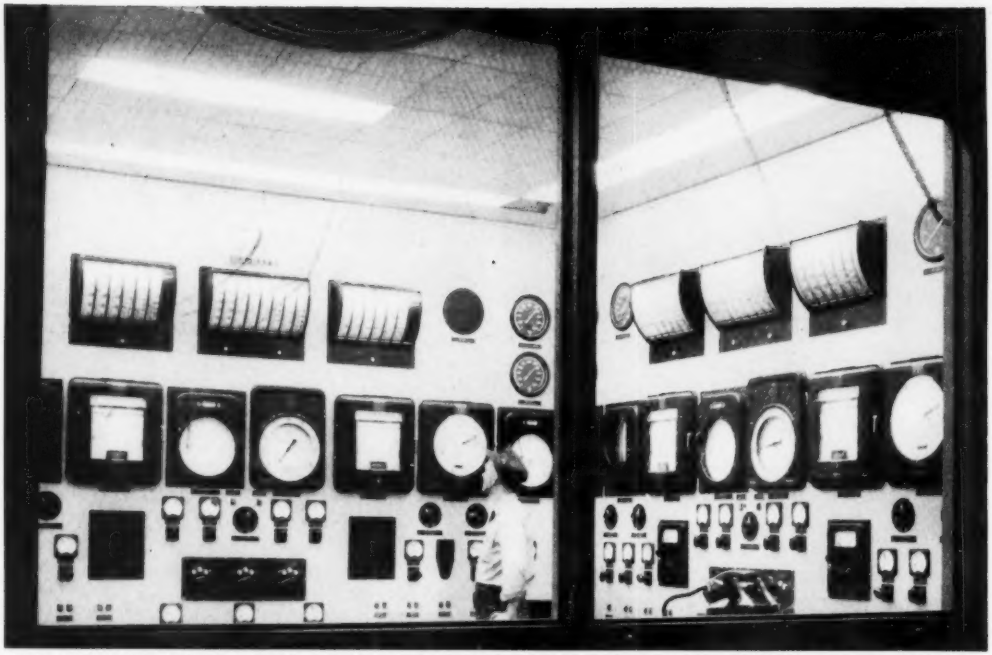
Its clear-cut drawings illustrate the basic components of efficient heat exchanger design, providing the basis for the specification of heat exchangers for almost every industrial application.

To obtain *your* copy, write for Bulletin 501.

for performance you can **BANK** *on*

SUPERIOR COMBUSTION INDUSTRIES INC.
TIMES TOWER, TIMES SQUARE, NEW YORK 18, N.Y.

SUPERIOR
HEAT EXCHANGERS



AIR CONDITIONED CONTROL ROOM ILLUSTRATES COMPLETE BOILER PLANT INSTRUMENTATION SUPPLIED BY HAYS.

MULTIPLE FUEL COMBUSTION CONTROL OF CYCLONE FURNACES

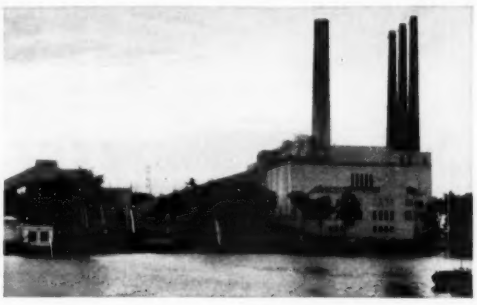
At Michigan City Station of Northern Indiana Public Service Co.*

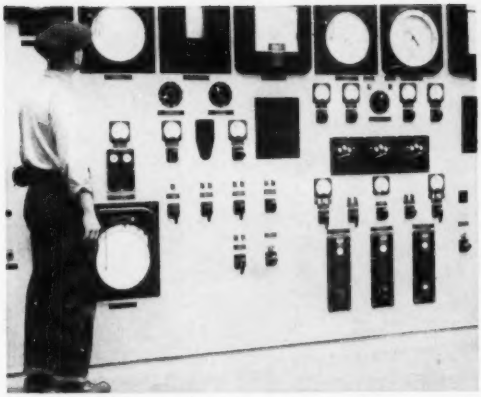
Flexible, efficient, safe firing of *both* coal and gas in cyclone furnaces is being achieved at the Michigan City, Indiana generating station of NIPSCO* by means of an electric combustion control system designed and built by engineers of The Hays Corporation working closely with company officials and the consulting engineers, Sargent & Lundy.

The system permits any desired allocation of load among the three boilers, between the two cyclone furnaces of a given boiler and between the two fuels being burned simultaneously in a given cyclone. Thus, any conceivable load-need or fuel supply situation can be accommodated.

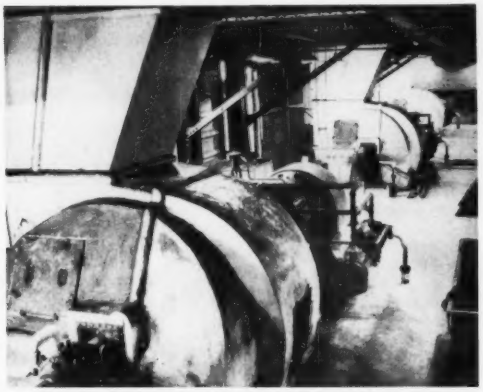
In addition, complete safety for the multi-million dollar installation is "built in" since each boiler is equipped with a system of mechanically and electrically interlocked selector switches arranged to require a definite sequence of operation in transferring from manual to automatic control and vice versa. For example, interlocks require that (1) the ID fan must be running (2) the ID fan damper must be partially open and (3) at least one of the FD fan duct dampers must be opened before the FD fan can be started.

This installation illustrates the care and ingenuity exercised by Hays engineers in solving the combustion control problems of boiler plant operators throughout the world—regardless of boiler size, fuels being burned, etc. Write for a free, fully illustrated, 8-page story on this central station —available from The Hays Corp., Michigan City, Indiana.

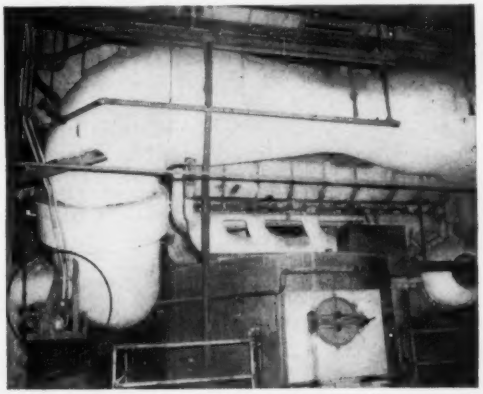




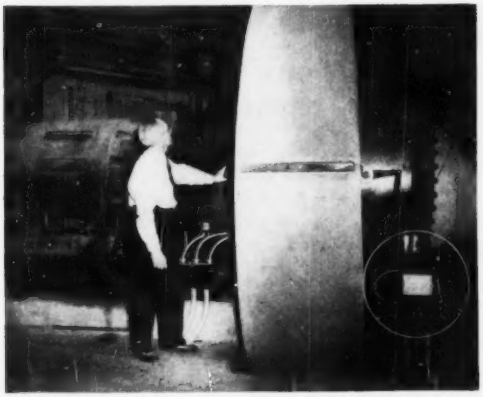
SPACE SAVING is achieved by mounting all position indicators, manual control stations, fuel-air ratio adjustments, and mechanical interlocks for one boiler inside control room near related instruments for convenience of operator (*at left*); controllers themselves are grouped on outside wall of control room for ease of inspection and maintenance (*at right*).



CORRECT FURNACE DRAFT is maintained by controlling induced draft fan inlet damper as well as induced draft fan speed. Latter is accomplished by means of hydraulic coupling equipped with reversing oil pump.



HUGE VENTURI in forced draft duct provides means of accurately measuring air to individual cyclone. The Hays power unit *(indicated within circle)* operates a damper in this forced draft duct.

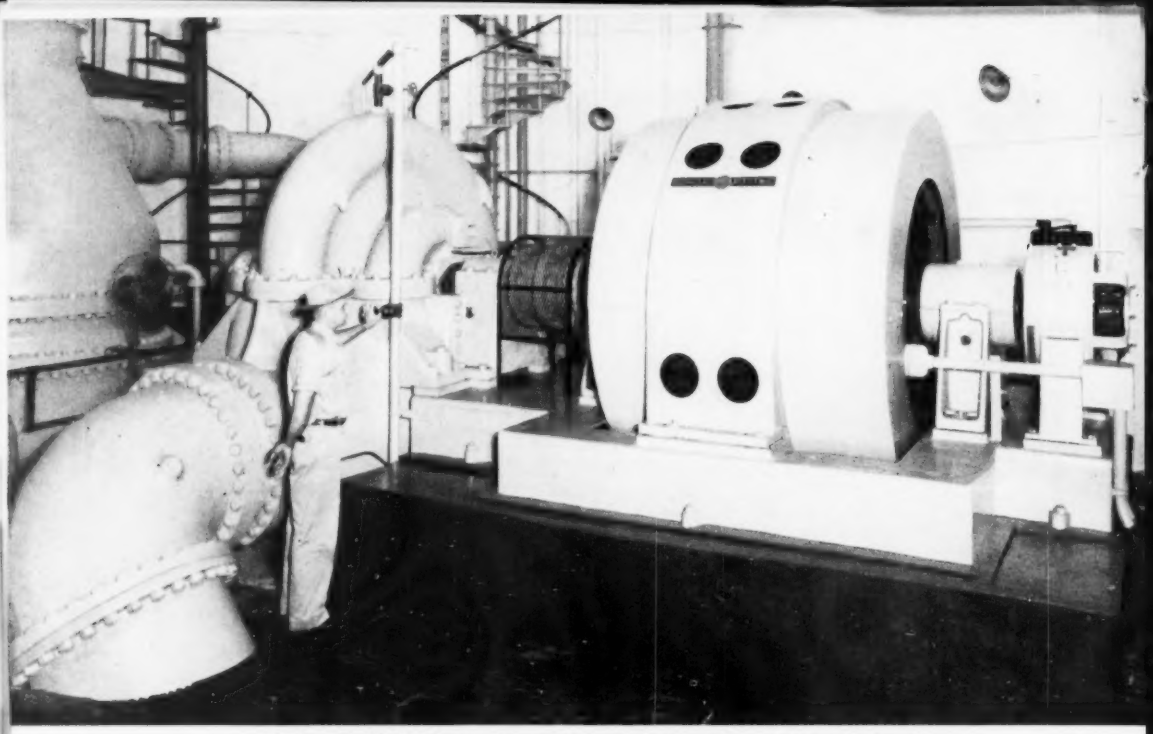


THREE 120,000 CFM, motor driven forced draft fans (one for each boiler) provide air for cyclones at 54" water pressure. Hays power unit (*circle*) adjusts forced draft fan inlet damper in response to forced draft duct pressure controller.

Automatic Combustion Control
Boiler Panels • Hays-Penn Flowmeters
Veriflow Meters and Veritrol
Gas Analyzers • Draft Gages
Combustion Test Sets • CO_2 Recorders
Electronic Oxygen Recorders

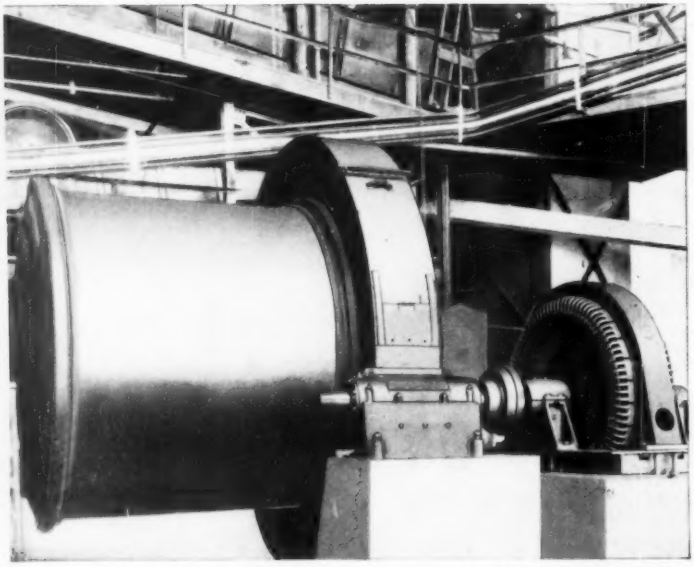
THE hays CORPORATION

MICHIGAN CITY 3, INDIANA

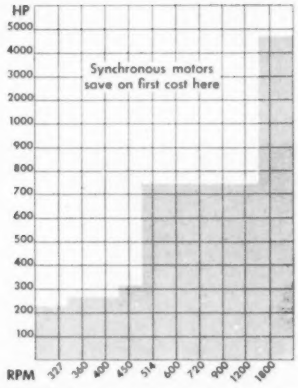


Savings in distribution equipment investment were made possible by selection of this General Electric 2500 hp synchronous motor for a municipal pumping station.

G-E Synchronous Motors

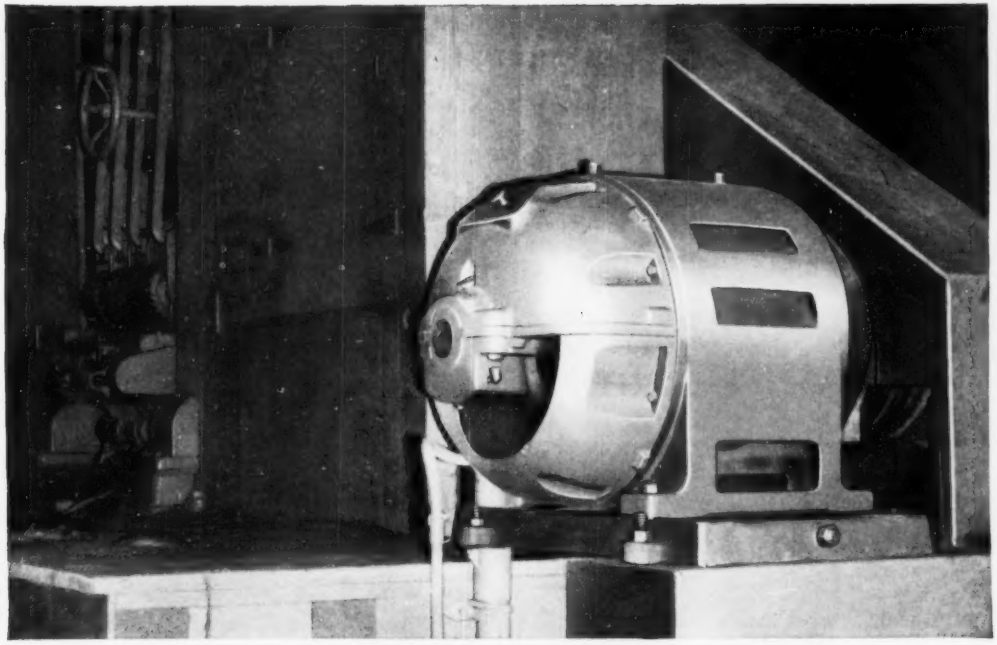


To meet the tough starting requirements of a ball mill, a mining company chose this G-E high-torque synchronous motor rated at 600 hp. Initial cost was low and the motor has given 20 years of dependable service.



Lower first cost of G-E synchronous motors is shown above. For applications in the white area, synchronous motors cost less than any other kind of motor. Calculations below show power savings on a typical 1000 hp, 514 rpm motor.

Gain in efficiency over other types of motors at same rating	**2.2%**
Hourly saving at power rate of $0.01 per/kwh	**$0.184**
Yearly saving (assuming constant operation)	**$1600.00**



Lower operating cost is the rule when General Electric Tri-Clad* synchronous motors are used with equipment such as this horizontal band re-saw, operating almost continuously at heavy loads.

Offer Double Savings

Lower First Costs, Lower Operating Costs Can Be Realized on Large, Constant-Speed Applications in Many Industries

Before you select a drive for a large equipment providing heavy and continuous service, be sure to investigate the economics of General Electric synchronous motors. On many applications such as pumps, compressors, fans, etc., outstanding savings are available.

LOWER FIRST COSTS

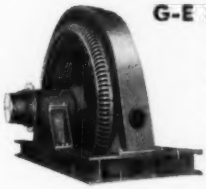
In most ratings where horsepower is equal to or greater than speed, the price tag on a synchronous motor with exciter and control is less than that of any other a-c motor with its control.

And, because a synchronous motor improves plant power factor, initial investment in distribution equipment frequently can be reduced. (The load which any new or expanded power system will carry is proportional to the plant's power factor.)

LOWER OPERATING COSTS

A synchronous motor usually has a higher full-load efficiency than any other type of motor, produces more work per dollar's worth of power consumed. Where loads are heavy and continuous, an advantage of from 0.5 to 3.0% in efficiency pays off.

Engineers with many years of field experience will tailor G-E synchronous motors and control to your job. Call in your General Electric representative—he'll be glad to discuss your particular application. And for more information on G-E synchronous motors, write for bulletins GEA-5332 (low-speed) or GEA-5426 (high-speed) to Section 770-26, *General Electric Company, Schenectady 5, N. Y.*



BE SURE TO SPECIFY G-E SYNCHRONOUS MOTORS

The result of more than 55 years experience in development, manufacture, and successful application, General Electric's line of synchronous motors is available in low speed and high speed types, engine-type and Tri-Clad* construction.

Numerous exclusive design and construction features promote long, dependable service. Get the full details!

*Reg. trademark U.S. Pat. Off.

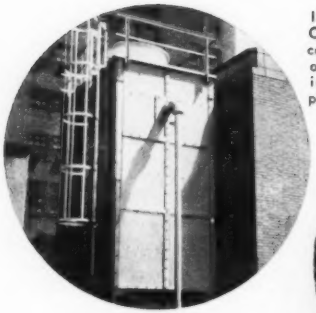
GENERAL ELECTRIC

770-26

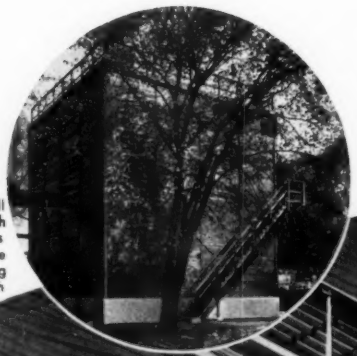
the same engineering excellence

in every Foster Wheeler

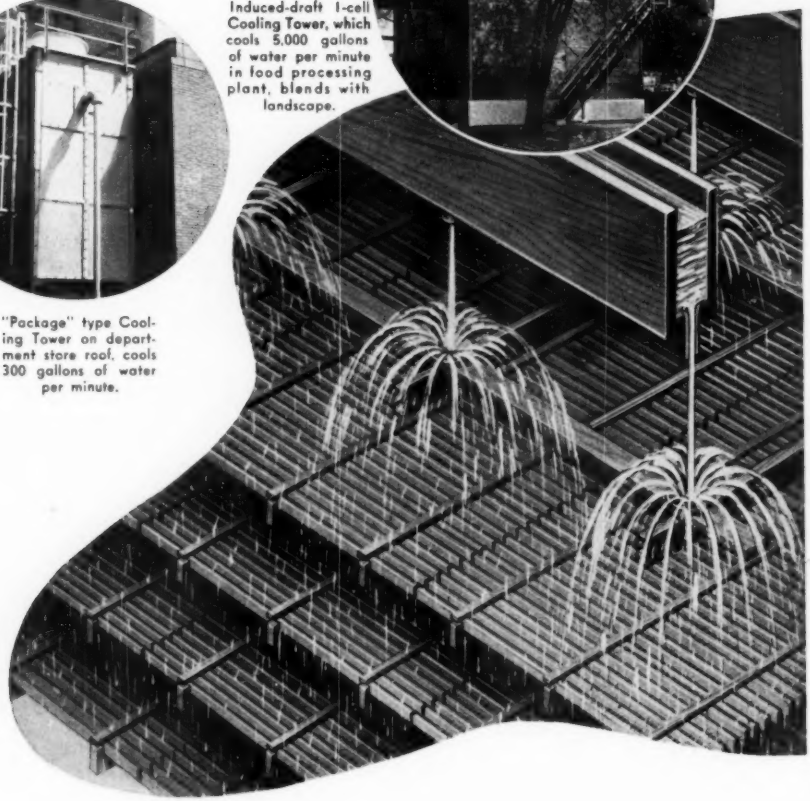
FROM THE SMALLEST...



"Package" type Cooling Tower on department store roof, cools 300 gallons of water per minute.



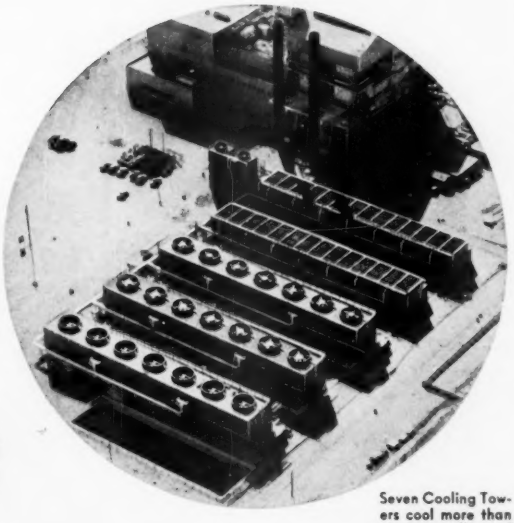
Induced-draft 1-cell Cooling Tower, which cools 5,000 gallons of water per minute in food processing plant, blends with landscape.



FOSTER WHEELER CORPORATION 165 BROADWAY

cooling tower

Induced-draft Cooling Tower in oil refinery cools 15,000 gallons of water per minute to within five degrees of the design wet bulb.



Seven Cooling Towers cool more than 180,000 gallons of water per minute in large power plant.

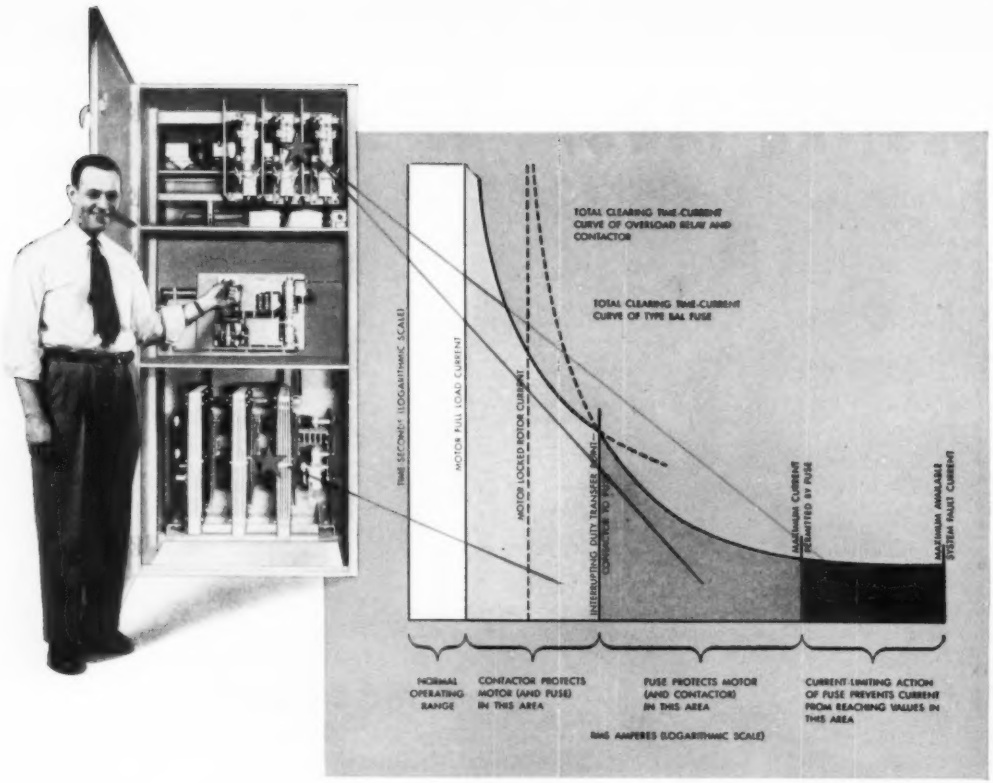
. . . TO THE LARGEST

Whatever the application—a "package" type on a department store roof in New York City, a twenty-cell tower for a power plant in Arkansas, or a large unit for a chemical plant in India, Foster Wheeler Cooling Towers can be depended on to deliver full capacity in year-round service.

A Foster Wheeler Cooling Tower is your best guarantee of a constant supply of cooling water for steam power plants, processing, air conditioning, or other uses. Regardless of size, the same engineering and construction excellence, the same attention to detail and the same quality of materials go into every Foster Wheeler installation.

NEW YORK 6, NEW YORK

FOSTER WHEELER


TOTAL CLEARING TIME-CURRENT CURVE OF OVERLOAD RELAY AND CONTACTOR
TOTAL CLEARING TIME-CURRENT CURVE OF TYPE BAL FUSE
TIME SECONDS (LOGARITHMIC SCALE)
MOTOR FULL LOAD CURRENT
MOTOR LOCKED ROTOR CURRENT
INTERRUPTING DUTY TRANSFER POINT—CONTACTOR TO FUSE
MAXIMUM CURRENT PERMITTED BY FUSE
MAXIMUM AVAILABLE SYSTEM FAULT CURRENT
NORMAL OPERATING RANGE
CONTACTOR PROTECTS MOTOR (AND FUSE) IN THIS AREA
FUSE PROTECTS MOTOR (AND CONTACTOR) IN THIS AREA
CURRENT-LIMITING ACTION OF FUSE PREVENTS CURRENT FROM REACHING VALUES IN THIS AREA
RMS AMPERES (LOGARITHMIC SCALE)

This co-ordinated protection safeguards men, motors and circuits

Men? Motors? Circuits? Which can be ignored at a high-voltage motor installation? Obviously, NONE. Yet, high-voltage protective equipment is often installed that DOES NOT safeguard all three.

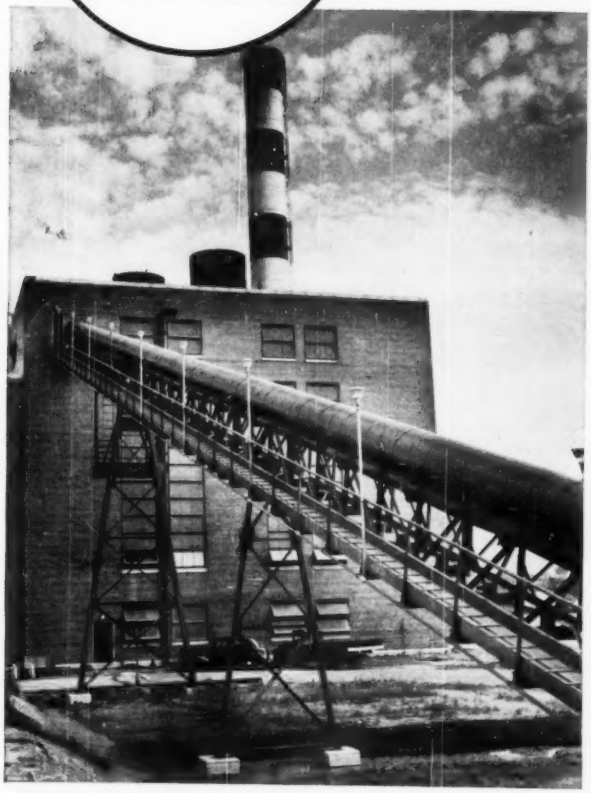
Protection must be co-ordinated to be complete. It must safeguard all elements under all conditions. Examine the above chart and note how a Westinghouse High-Voltage Combination Starter co-ordinates fuses and contactor to provide continuous protection for both motors and circuits. Note how the sectionalized steel cabinet protects personnel and equipment.

Co-ordinated protection also safeguards production. No chance for high current faults to bypass the starter and damage equipment. Down time is confined to correcting the fault and then reclosing the circuit.

The advantages of Westinghouse Co-ordinated Protection are many. Talk them over with your Westinghouse representative. Or, write for booklet B-4673 "High-Voltage Motor Starters". Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-27029

YOU CAN BE SURE... IF IT'S
Westinghouse
HIGH VOLTAGE STARTERS

S-A CONVEYING Systems give you a *complete* answer to your **COAL** handling, storage and reclaiming problems



This S-A conveyor can carry 100 tons of 1½" coal per hour from a ground level receiving hopper to bunkers in the power plant. The conveyor levels off into an 82-foot horizontal run above the bunkers where the coal is distributed into the desired bunker by a self-propelled belt tripper.

An engineering staff backed by over 50 years' experience is at your service when you call in Stephens-Adamson to solve your coal handling problems. Since S-A has a complete line of bulk materials handling equipment to draw from, they can give you unbiased opinions about the most efficient type of equipment to install.

Whether you need a simple conveyor unit or a complete distribution system, it will pay you to call in an S-A engineer. There's no obligation, of course, so write today.

Belt Conveyors & Trippers
REDLER Conveyor-Elevators
ZIPPER Conveyor-Elevators
Weigh Larries
Crushers, Roll & Ring Type
Bucket Elevators
Gravity Discharge Conveyors
Pivoted Bucket Carriers
"Natural Frequency" Vibrating Conveyors
Screw Conveyors
Skip Hoists
Belt, Pan & Plate Feeders
Track Hoppers & Bin Gates
Conveyor Belt Cleaners
Headshaft Holdbacks
Car Pullers & Spotters
TELLEVEL Bin Level Controls
Centrifugal Pilers
Water Intake Screens
SEALMASTER Ball Bearing Units

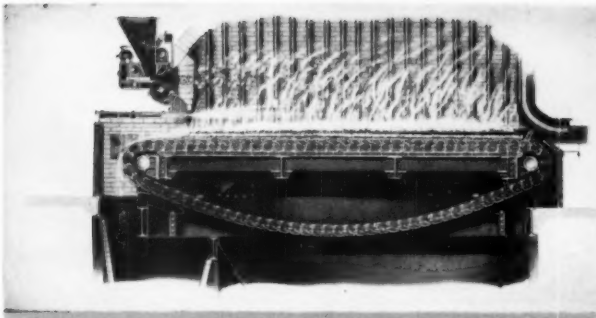
Write for bulletins on any of the above.

STEPHEN S-A ADAMSON MFG. CO.

5 Ridgeway Avenue, Aurora, Illinois — Los Angeles, Calif., Belleville, Ontario

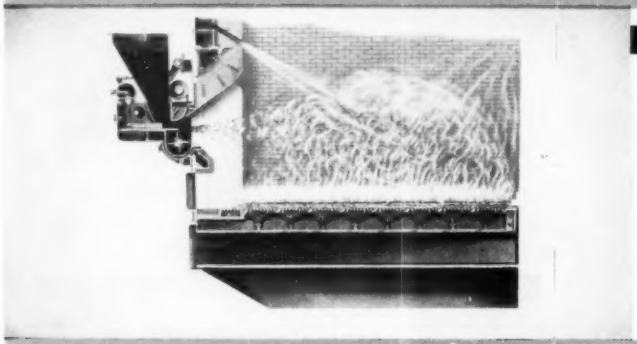
DESIGNERS AND MANUFACTURERS OF ALL TYPES OF BULK MATERIALS HANDLING EQUIPMENT

ERIE CITY
FOR YOUR SPECIFIC



"TRAVAGRATE"

In the "Travagrate," flexibility, to handle widely varying load demands, is combined with ruggedness. The Erie City "Triple Feeder" and distribution controls assure accurate fuel spreading over the moving grate. Our latest bulletin, which is offered in the convenient coupon below, shows in detail these and many other features.

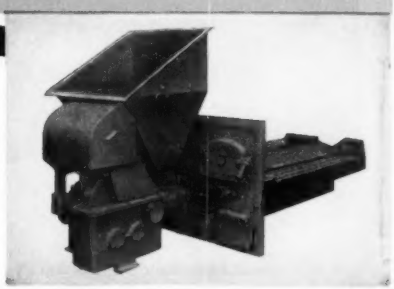


DUMPING GRATE

The Erie City Dumping Grate Spreader uses the same "Triple Feeder" and Fuel Distribution system as the "Travagrate." All stoker parts exposed to furnace heat are made from a special heat resisting alloy iron in our own foundry. When required, parts of Erie City Spreader Stokers exposed to furnace heat are air and water cooled.

UNDERFEED RAM TYPE SIDE DUMP STOKER

There is an Erie City Single-Retort Underfeed Stoker for practically every type of boiler to handle steam loads up to 700 developed boiler horsepower. These stokers are furnished in low-set and heavy-duty models. Our bulletin gives details and illustrates various applications.

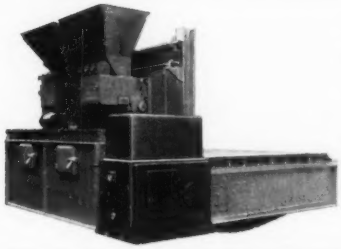


ERIE CITY IRON WORKS

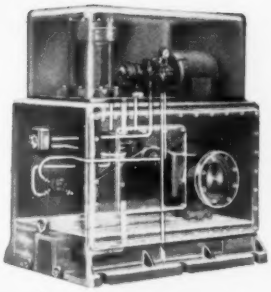
STEAM GENERATORS • SUPERHEATERS • ECONOMIZERS • AIR PREHEATERS
UNDERFEED and SPREADER STOKERS • PULVERIZERS

STOKERS
REQUIREMENTS

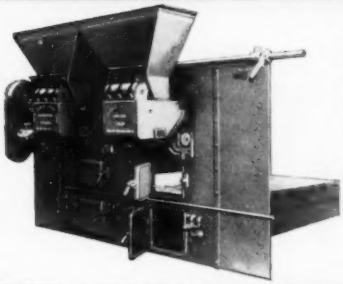
CONTINUOUS ASH DISCHARGE SPREADERS



The Erie City Hydraulic Drive unit is completely housed in an oil-tight unit without external piping. The fluid drive transmits power to the main shaft through a linkage and ratchet gear. A single control valve regulates grate speed.



TYPE SPREADER STOKERS



Grate units are interchangeable and easy to remove or replace. The bulletin offered below fully describes how dumping grates are connected to dumping bars which are actuated for ash disposal by power cylinders — either steam or air powered. A 4-way hand operated valve is located on the lower front to the right of each ash door.

You can study the design and construction of Erie City Stokers by simply filling in the handy coupon below. As a designer and manufacturer of dependable steam generating equipment for over 112 years, we believe you will discover that Erie Stokers reflect this experience. If you use coal we want you to know Erie City Stokers regardless of whether you plan new power, process, or heating installations. These stokers were designed to meet the exacting needs of industry in the efficient production of steam. If you wish to consult with an Erie City engineer or obtain copies of our stoker literature, let us know by mailing the coupon below.

Erie, Pa.

ERIE CITY IRON WORKS
ERIE, PA.

Gentlemen:

☐ We are interested in seeing your stoker bulletin: ☐ Underfeed ☐ Spreader.

☐ We would like to discuss Stokers with an Erie City engineer.

NAME_____

TITLE_____

COMPANY_____

CITY_____ STATE_____

Look for Economy
WHEN YOU BUY HEATING PUMPS

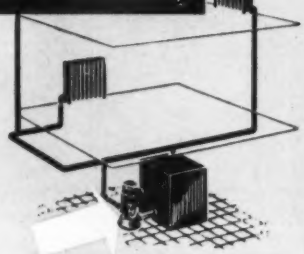
WHEELER-ECONOMY HEATING PUMPS
with Better-Than-Ever Engineering and Quality Control

With the consolidation of Economy Pumps, Inc. and C. H. Wheeler Manufacturing Company, the heating pumps you have always bought as "the best in the field" will now be sold as WHEELER-ECONOMY HEATING PUMPS. Representatives are being appointed in key areas to give you good service with a time-honored line of heating pumps that is now *better than ever*.

The Wheeler-Economy line of heating pumps has undergone a complete engineering check-up and reanalysis from the castings out. Many refinements have been made and a new face-lifting has been effected . . .

TYPES FOR EVERY BASIC HEATING PROBLEM

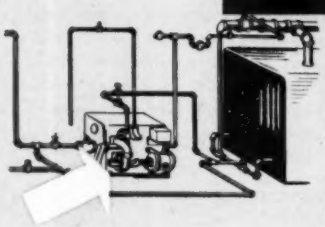
FOR HOT WATER



HOT WATER CIRCULATION

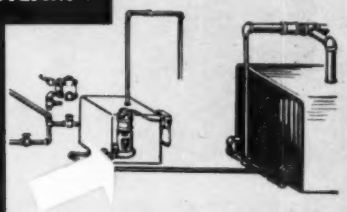
Wheeler-Economy Pumps deliver hot water to radiators quickly and return warm water to boiler with minimum heat loss.

FOR STEAM



STEAM VACUUM

The Wheeler-Economy Vacuum Producer is the most efficient design ever devised for removing air and water from condensate return lines.



RETURN CONDENSATION

Wheeler-Economy Pumps combine outstanding performance with low power cost in a compact dependable design.

WHEELER-ECONOMY HOT WATER CIRCULATING PUMPS

Type SCV—Vertical direct connected centrifugal pump. Sizes 1" to 3". Capacities to 500 GPM. Various RPM speeds 1150 to 3450. Heads to 225'.

Type SCC—Close coupled vertical or horizontal mounted. Sizes 1½" and 2". Capacities to 100 GPM. 3450 RPM. Heads to 120'.

TYPE SCV

TYPE SCC

WHEELER-ECONOMY VACUUM PUMPS

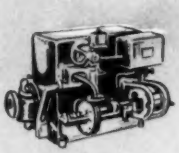
Type VV—Vertical Vacuum Pumps—Suitable for use on all ordinary jobs operating between 3 and 12 inches of vacuum. Made for all discharge pressures up to 150 lb. per sq.in. Capacity sq.ft. E.D.R. 2500 to 15,000. Single and duplex units.

Special Capacities—VVS and VVSD single and duplex units recommended wherever capacity of system or air leakage is greater than ordinary. Also where lifts or pockets in the returns necessitate carrying higher vacuum. (Example: 10 to 16 inches.)

Type SVA—Horizontal Vacuum Pumps—For ordinary jobs operating between 3 and 12 inches of vacuum. Discharge pressures up to 150 lb. per sq.in. Capacity sq.ft. E.D.R. 20,000 to 100,000. Single and duplex units.

Special Capacities—Styles SVS single unit and DVS Duplex Unit, recommended where air capacity or air leakage in the system is greater than ordinary. Also where lifts or pockets in return require the carrying of higher vacuum—example 10 to 16 inches.

TYPE VV



TYPE 5VA

WHEELER-ECONOMY RETURN CONDENSATION PUMPS

Type E—Operate at 1750 RPM or for 50 cycle current at 1440 RPM. The best pump where extremely quiet operation is desired. Single and duplex units. Capacity sq.ft. direct C.I. radiation or equivalent: 1000 to 65,000.

Type EC—Available for the same or higher pressure than handled by Type E pumps. Operate at 3450 RPM. Units for 50 cycle current operate at 2880 RPM. Capacity sq.ft. direct C.I. radiation or equivalent 1000 to 65,000. Single and duplex units.

Vertical Underground Pump—Used where returns are below floor level or otherwise too low for horizontal pumps. Cast Iron tank can be installed flush with floor. No pit required for pump. Low and medium pressure units equipped with single stage pumps of vertical design. For higher pressure units a multistage pump of special design is used. Capacity in sq.ft. direct C.I. radiation or equivalent 2000 to 50,000. Single and duplex units.

Type S—Condensation Pump with Steel Receiver—An "Economy" installation where service is not severe and heavy construction cast iron tanks are not required. Where steel receiver is satisfactory and low cost is of primary importance Type S is recommended. However, these low cost models are the equal of the top grade in many competitive lines. Single or duplex units.

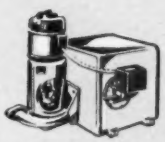
Type MR—Lightweight Pump for low pressure steam heating systems. Priced to meet competition . . . with no compromise in workmanship and materials. Capacities up to 65,000 sq.ft. E.D.R. Single and Duplex Units.

Types B and C—Horizontal Return Condensation Pumps—Type B multi-stage pump for pressures up to 150 lbs. 1750 RPM. Quiet operation. Capacities in sq.ft. direct C.I. radiation equivalent to 6000 to 65,000.

Type C multi-stage pump for pressures up to 175 lbs. 3600 RPM 60 cycle. Identical to type B except for higher speed operation. Capacities in sq.ft. direct C.I. radiation equivalent to 6000 to 65,000.

Type G—Horizontal Return Condensation Pump—Type G single suction, single stage designed for medium and high pressures at motor speeds 1800 to 3450 RPM. Receivers of all three types, "B", "C" and "G" are welded steel plate unless otherwise ordered.

All Wheeler-Economy Heating Pumps are tested before shipment and guaranteed for workmanship and materials.

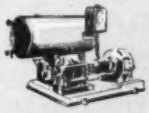


TYPES E & EC

TYPE U

TYPE S

TYPE MR



TYPES B & C

TYPE G

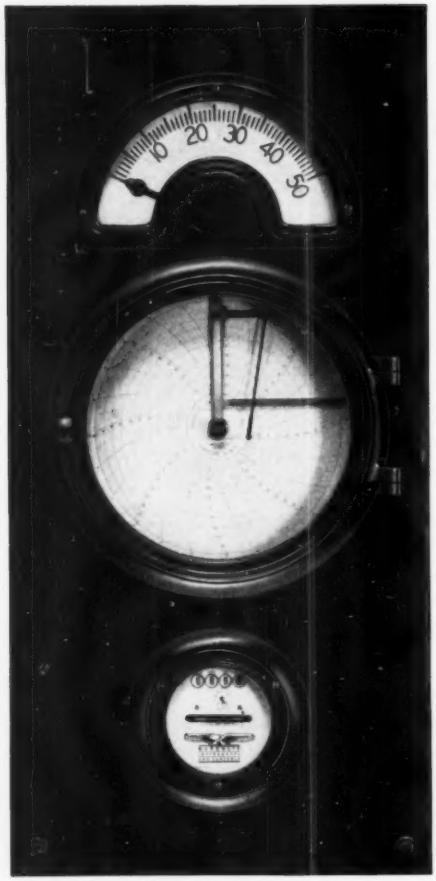
SOME TERRITORIES STILL AVAILABLE FOR REPRESENTATIVES WHO QUALIFY

Over 15 million dollars' worth of these pumps are in use throughout the United States

126

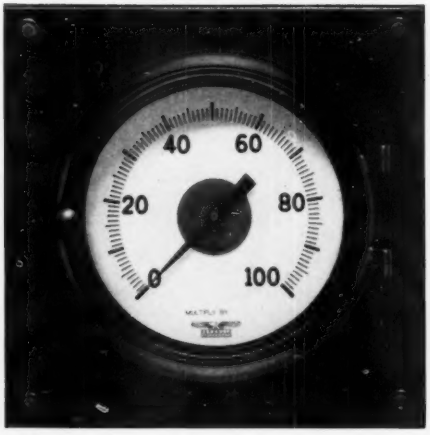
WHEELER-ECONOMY PUMPS

ECONOMY PUMPS, INC., DIVISION OF C. H. WHEELER MANUFACTURING CO.
19TH AND LEHIGH, PHILADELPHIA 32, PA.



Indicator-Recorder-Integrator

Varying flows because the



Indicator

The Republic flow integrator, being of the modified watt-hour type, totalizes continuously —not intermittently. It operates independently of the recorder and its accuracy is not dependent on or affected by any clock mechanism or mechanical action.

The Republic meter is, on this account, peculiarly fitted to follow all changes in flow rate and accurately measure highly fluctuating flows.

ALL TYPES OF FLUIDS

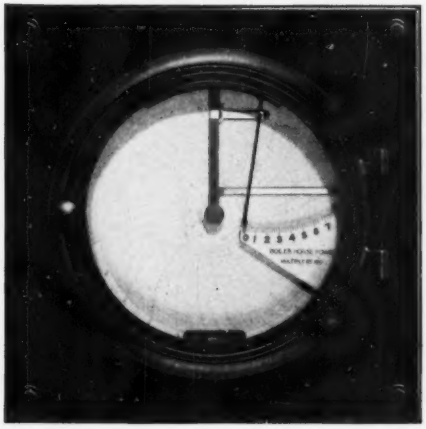
Republic electric type flow meters are available for measuring the flow of all types of liquids and gases. Meter bodies are built for metering fluids at line pressures up to 5,000 lb. per sq. in. and for all ranges of differential pressure. The reading instruments — indicator, recorder and integrator—are of the remote reading type and can be located any distance from the point of flow measurement.

ANY COMBINATION

While each Republic reading instrument is standard in design and construction each is especially calibrated for the particular flow measurement for which it is specified. Any reading instrument, indicator, recorder or integrator, may be obtained separately or in any

are accurately totalized

integrator is continuous



Recorder

Integrator

combination desired, making possible the highest degree of flexibility in plant use.

SIMPLE IN OPERATION

The Republic electric meter is the only flow meter commercially manufactured which is strictly electric in its operation. All other types of so called electric meters use the motion of the mercury to move a float or produce a force which is then converted into an electrical value which is in turn transmitted to a receiving or reading instrument. In the Republic meter, the transmitted electrical value is determined directly by the mercury motion, thus eliminating one of the steps in the sequence, and simplifying the mechanism to that extent. Their are no floats, levers, cams, rotating shafts or anything else to interfere with the unimpeded movement of the mercury, which has no work to perform, but merely fulfills the function of making contact.

NEW DATA BOOK

Just off the press—a completely new data book describing and illustrating, in detail, the operating features of the Republic Flow Meter and its many applications. Write for your copy of Data Book No. 702—there is no obligation.

REPUBLIC FLOW METERS CO. ● 2240 DIVERSEY PARKWAY • CHICAGO 47, ILLINOIS

TERRY

The rotor of a Terry Solid-wheel Turbine is a single forging of special composition steel. It is first rough turned in two operations, as illustrated, and then two cuts are taken to mill the semi-circular buckets from the solid metal. The wheel at the top has been finished, ready for mounting on the shaft. *The result is a single-piece wheel with no parts to loosen or work out.*

As the only function of the blades is to form a series of pockets, wear of the blades is of little consequence and does not materially affect the horsepower or efficiency. The important part of the bucket is the back, or bottom, which is a solid forging.

It is impossible for the blades to foul. They have large clearances, and are further protected by the projecting rims at the sides of the wheel. As the side clearances are also very large, end play can do no harm.

The Terry Solid-wheel Turbine is an extremely reliable piece of equipment. Why not write for complete details today?

THE TERRY STEAM TURBINE CO.
TERRY SQUARE, HARTFORD 1, CONN.

TT-1188

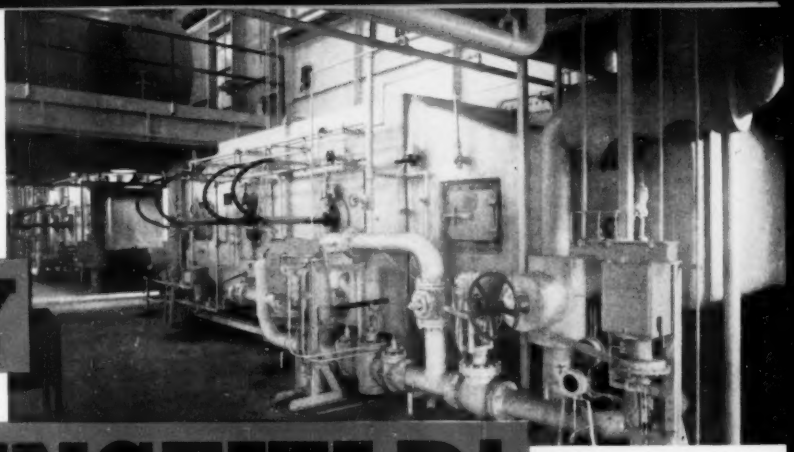
Memo

Send for a copy of bulletin S-116 which describes the many advantages of the Terry Solid-wheel Turbine.

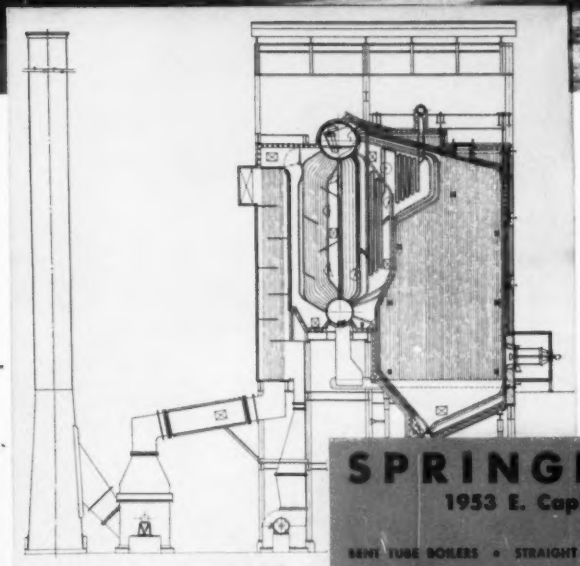
The W. R. (Bob) Poage Steam Plant, Belton, Texas, an outstanding example of modern, outdoor installation, features TWO Springfield Steam Generating Units. *Consulting Engineers:* Laramore and Douglass, Inc., Chicago, Illinois.

Right:—A view on the operating floor showing firing arrangement of Springfield Steam Generators.

Below:—The design cross-section.



WHY SPRINGFIELD!



. . . a story of multiple sales

SPRINGFIELD Steam Generating Units combine modern design and efficiency with low initial and operating costs. That is why Springfield Boiler Co. enjoys so many repeat orders. For example, less than two years after the initial installation, this duplicate unit was added to the W. R. (Bob) Poage Steam Plant at Belton, Texas, to provide additional economical, trouble-free capacity.

Springfield specializes in the design and production of modern, efficient steam generating equipment—TAILORED TO SPECIFIC NEEDS—of size—pressure—temperature—and fuel. For economy, for ease of operation, for long, trouble-free service, write Springfield Boiler Co. today.

DESIGN DATA

Capacity	130,000 lbs. per hr.
Operating Pressure	630 psig
Total Steam Temperature	825°F.
Number of Drums	2
Type	Bent Tube
Fuel	Oil or Gas
Installation	Outdoors

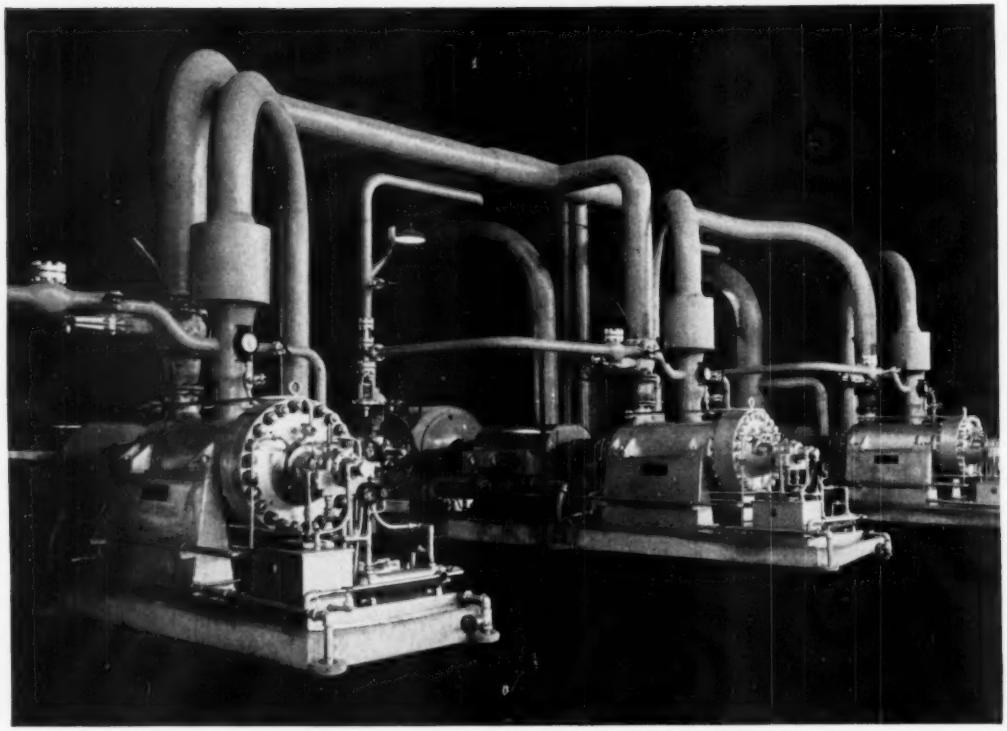
SPRINGFIELD BOILER CO.

1953 E. Capitol Ave., Springfield, Illinois, U. S. A.

Worldwide Sales and Service

BENT TUBE BOILERS • STRAIGHT TUBE BOILERS • SUPERHEATERS • DESUPERHEATERS • AIR HEATERS
ECONOMIZERS • WATERWALLS • PACKAGE BOILERS • COMPLETE STEAM GENERATING UNITS

WRITE FOR LITERATURE ON DESIGN AND INSTALLATIONS



The Yates Plant of the Georgia Power Company showing piping from boiler feed pumps insulated for life with "Featherweight" 85% Magnesia. **Insulation Contractor:** Armstrong Cork Co.

"HEAT WAVE" with no relief in sight—

ONCE steam is produced, "Featherweight" 85% Magnesia does the vital job of keeping it *hot* . . . has been known throughout industry for 60 years as an outstandingly efficient and economical insulation in all heating applications up to 600° F.

Thoroughly time-tested, and continually kept up to the minute through laboratory research to meet the increasing demands of modern industry, "Featherweight" 85% Magnesia is specified wherever exacting steam temperature control is required . . . in power stations and ships, in hospitals and food processing plants, in oil refineries and chemical installations.

"Featherweight" 85% magnesia is on the job!

"Featherweight" 85% Magnesia is known for its lasting durability as well as its efficient heat control. Its insulating qualities are unaffected under the alternate expansion and contraction of steam system start-ups and shut-downs.

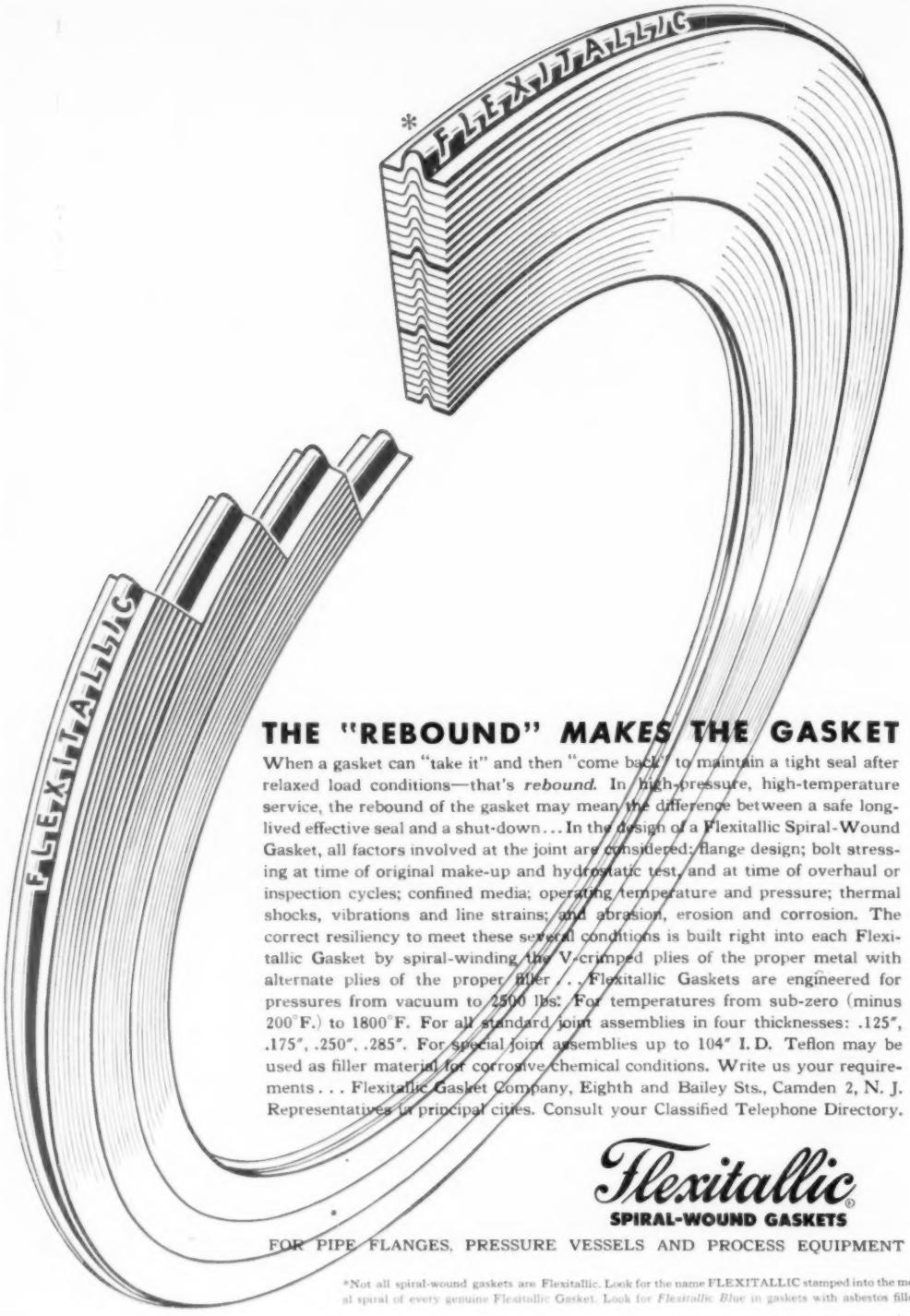
Being entirely mineral in nature, it will not burn. "Featherweight" 85% Magnesia stays on the job for the life of the heating system. Teamed up with K&M Hy-Temp Insulation it is efficient for temperatures up to 1900° F.

Your Keasbey & Mattison Distributor, who is an experienced applicator, will be glad to give you complete information on "Featherweight" 85% Magnesia. Or, write us direct.

Nature made Asbestos...
Keasbey & Mattison has made it serve mankind since 1873

KEASBEY & MATTISON
COMPANY • AMBLER • PENNSYLVANIA
In Canada: **Atlas Asbestos Company, Ltd., Montreal, Toronto, Winnipeg, Vancouver**

For trouble-free
flow control, install
POWELL VALVES
Because Powell Valves are engineered to meet the specific conditions under which they must operate, they have an enviable reputation for long, dependable performance with minimum maintenance.
That is why there are more kinds of Powell valves in service today than any other make.
The Wm. Powell Company
Cincinnati 22, Ohio
Fig. 11303 W. E. 1500-pound Cast Steel Pressure Seal Gate Valve with welding ends. One of many Powell designs for Power Plants
POWELL
BRONZE, IRON, STEEL AND CORROSION-RESISTING VALVES
DEPENDABLE VALVES
SINCE 1846



THE "REBOUND" *MAKES* THE GASKET

When a gasket can "take it" and then "come back" to maintain a tight seal after relaxed load conditions—that's *rebound.* In high-pressure, high-temperature service, the rebound of the gasket may mean the difference between a safe long-lived effective seal and a shut-down... In the design of a Flexitallic Spiral-Wound Gasket, all factors involved at the joint are considered: flange design; bolt stressing at time of original make-up and hydrostatic test, and at time of overhaul or inspection cycles; confined media; operating temperature and pressure; thermal shocks, vibrations and line strains; and abrasion, erosion and corrosion. The correct resiliency to meet these several conditions is built right into each Flexitallic Gasket by spiral-winding the V-crimped plies of the proper metal with alternate plies of the proper filler . . . Flexitallic Gaskets are engineered for pressures from vacuum to 2500 lbs. For temperatures from sub-zero (minus 200°F.) to 1800°F. For all standard joint assemblies in four thicknesses: .125", .175", .250", .285". For special joint assemblies up to 104" I.D. Teflon may be used as filler material for corrosive chemical conditions. Write us your requirements . . . Flexitallic Gasket Company, Eighth and Bailey Sts., Camden 2, N. J. Representatives in principal cities. Consult your Classified Telephone Directory.

Flexitallic®
SPIRAL-WOUND GASKETS

FOR PIPE FLANGES, PRESSURE VESSELS AND PROCESS EQUIPMENT

*Not all spiral-wound gaskets are Flexitallic. Look for the name FLEXITALLIC stamped into the metal spiral of every genuine Flexitallic Gasket. Look for *Flexitallic Blue* in gaskets with asbestos filler.

Leonardo da Vinci

THIS YEAR the world celebrates the 500th birthday of Leonardo da Vinci, the most versatile creative genius known to history. Born in Tuscany, Italy, 40 years before another famous Italian discovered America, Leonardo climbed to the very top in both art and engineering, something never done, before or since, by any other human being.

In art, he won immortality by such magnificent paintings as *The Last Supper* and *Mona Lisa*. That he was also an engineering genius was proved by the 5000 pages of his unique notebook, filled with his brilliant mechanical inventions—many born centuries before the world was ready to receive them. In this notebook we see the first known sketches of trussed bridges, clock pendulums and steadily rotating lathes—also, an endless variety of pumps, water wheels, rolling mills, screw cutting machines, taxi meters, mirror grinders, gear trains, testing machines and weapons.

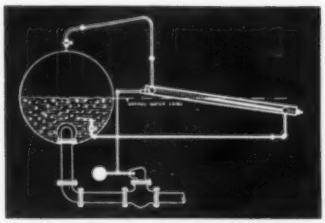
In an age, like ours, of new frontiers and international turmoil, Leonardo lived a full life. It is pleasant to imagine what his genius could accomplish in the setting of this twentieth century. At the very minimum, the Leonardo of 1952 would be Ford, plus Edison, Bell and Wright —perhaps Einstein too.

His great soul would revel in the opportunities of this machine age. Above all, we feel, he would welcome and use the electric power that frees modern man from the limitations of human and animal muscle.

Looking back over five centuries, we power engineers of 1952 salute our brilliant brother born in 1452.

COPES

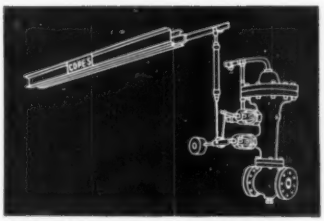
BOILER FEED WATER CONTROL



Simple-level-control COPES Type BI Regulator. Thousands in use.

Simple Level Control

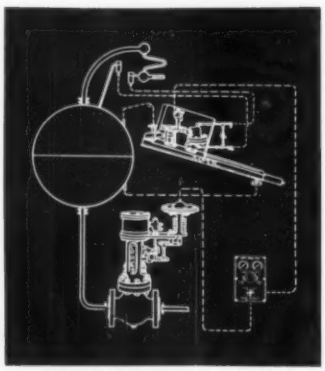
The original continuous-feed regulator in modern design, feeding according to boiler water level. For moderate pressures and ratings; for stable loads. Fully-automatic Type BI (Leaflet P-1-P). For small boilers, Type OT (Leaflet P-2-P).



COPES Flowmatic Type D-O. Most widely used two-element control.

COPES Flowmatic Control

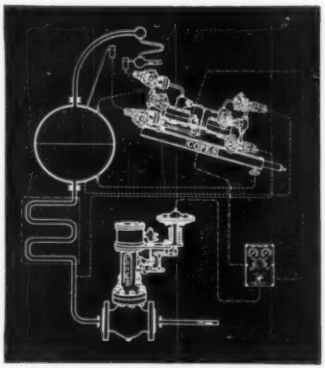
Feeds according to water level and steam flow. Independent of all other instruments and controls. For fast-steaming boilers. Direct-operated (Bulletin 429-P). Relay-operated or air-operated for flexible installation (Bulletin 441-P).



COPES Flowmatic Type A-O permits installation to meet any piping layout or operating preference.

Balanced Flow Control

Three control influences; water level, steam flow, water flow. Suited for highest pressures and ratings, for severest load conditions. Stays on fully-automatic when other boiler instruments and controls must be out of service. Leaflet P-25-P.



Schematic drawing of three-influence COPES Balanced Flow Control.

Control Through Hydraulic Couplings

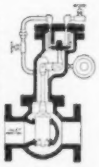
Either the two-element COPES Flowmatic or the three-influence Balanced Flow may be applied directly to hydraulic couplings of boiler feed pumps, eliminating the feed control valve. Complete engineering data on request. Please outline fully your operating conditions and desires.

COPES

BOILER FEED

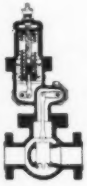
Directory

DIFFERENTIAL CONTROL



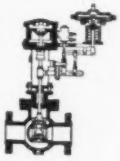
COPES engineers pioneered differential pressure control. Type SS-2 illustrated (Leaflet P-P) is direct-operated. Other types, relay- or master operated, are built for all operating requirements.

PUMP CONTROLS



COPES Pump Controls include simple pump governors (Type SDS-2 is shown; Leaflet P-P), master control systems, complete bypass or recirculating systems for pump protection. Engineering data on request.

REDUCING VALVES



Built for the jobs too difficult to be handled effectively by the ordinary stock valves. Individually built for your specific needs. Accurate. Dependable. Low velocities mean low noise level. Bulletin 477-P.

SELF-CONTAINED DESUPERHEATERS

Completely self-contained. Needs no alloy steel in downstream piping—no extra connections into this line—no run of piping to temperature element. Low velocities minimize vibration, wear and noise. Cooling water is controlled and fully atomized inside chamber, eliminating extra connections. As accurate on light flows as on full loads. Low-cost maintenance. Bulletin 405-P.

You'll find COPES a dependable source of supply for flow, level, pressure and temperature controls as shown here. Each unit will be designed and built for the conditions you specify—for optimum performance at minimum over-all cost. Write in detail when you have a tough problem.

NORTHERN EQUIPMENT DIVISION
Continental Foundry & Machine Company
621 GROVE DRIVE, ERIE, PENNSYLVANIA

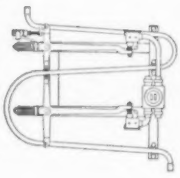
BOILER STEAM TEMPERATURE CONTROL

Maintains uniform steam temperature over full boiler load range, under all load conditions. Actuated by outlet steam temperature and rate of steam flow. For recommendations, explain your needs.

LIQUID LEVEL CONTROLS

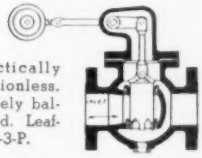
For open or closed vessels. Improved float chambers or flange-type floats, with mechanical or fluid connections to COPES Balanced Valves. Pressures to 400 psi.

HI-LOW WATER ALARMS



Operates dependably at any pressure from 25 to 1500 psi. Protects during start-ups and shut-downs. No internals to wear or foul. Leaflet CN 205-002-P.

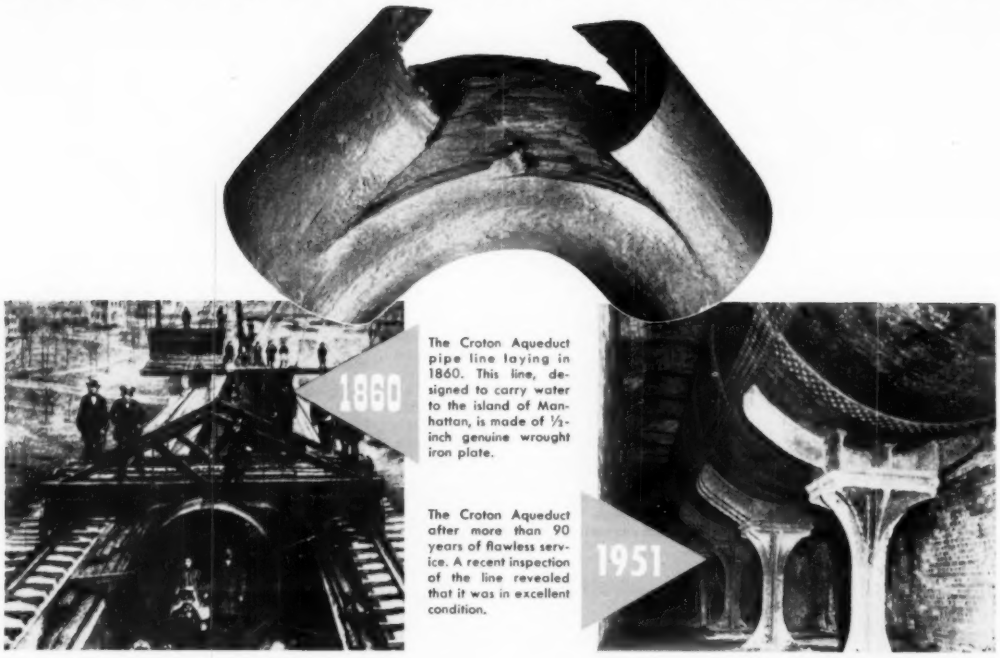
BALANCED CONTROL VALVES



Practically frictionless. Closely balanced. Leaflet P-3-P.

WATER REGULATION

Here's why GENUINE WROUGHT IRON



The Croton Aqueduct pipe line laying in 1860. This line, designed to carry water to the island of Manhattan, is made of ½-inch genuine wrought iron plate.

The Croton Aqueduct after more than 90 years of flawless service. A recent inspection of the line revealed that it was in excellent condition.

makes INSTALLATIONS LAST

Remarkable genuine wrought iron performance records similar to the Croton Aqueduct installation are recorded for a wide variety of services in practically every industry. The secret behind this material's ability to extend its "life-span" in corrosive services is illustrated in the notch-fracture test specimen pictured above.

This notch-fracture shows the unique fibrous structure of genuine wrought iron. Tiny threads of glass-like silicate slag, 200,000 to 250,000 per square inch of section, are distributed through the body of high-purity iron. These slag fibers are unaffected by corrosion, and set up mechanical barriers that halt and disperse corrosive attack, discourage pitting and rapid penetration. The fibers also anchor the initial protective scale, which shields the underlying metal.

Genuine wrought iron's service records from the past are providing an increasing number of the nation's leading engineers and designers with a reliable guide for material selection today. We will welcome the opportunity to review your corrosion problems with you —and to recommend the places where genuine wrought iron—on the basis of past experience—can be used to help cut maintenance costs.

A. M. Byers Company, Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, San Francisco. Export Division: New York, N. Y.

Send for this booklet Today

Interesting case studies of genuine wrought iron installations from the past are presented pictorially in this new, non-technical booklet, "Proof by Performance." There's a copy waiting for you.

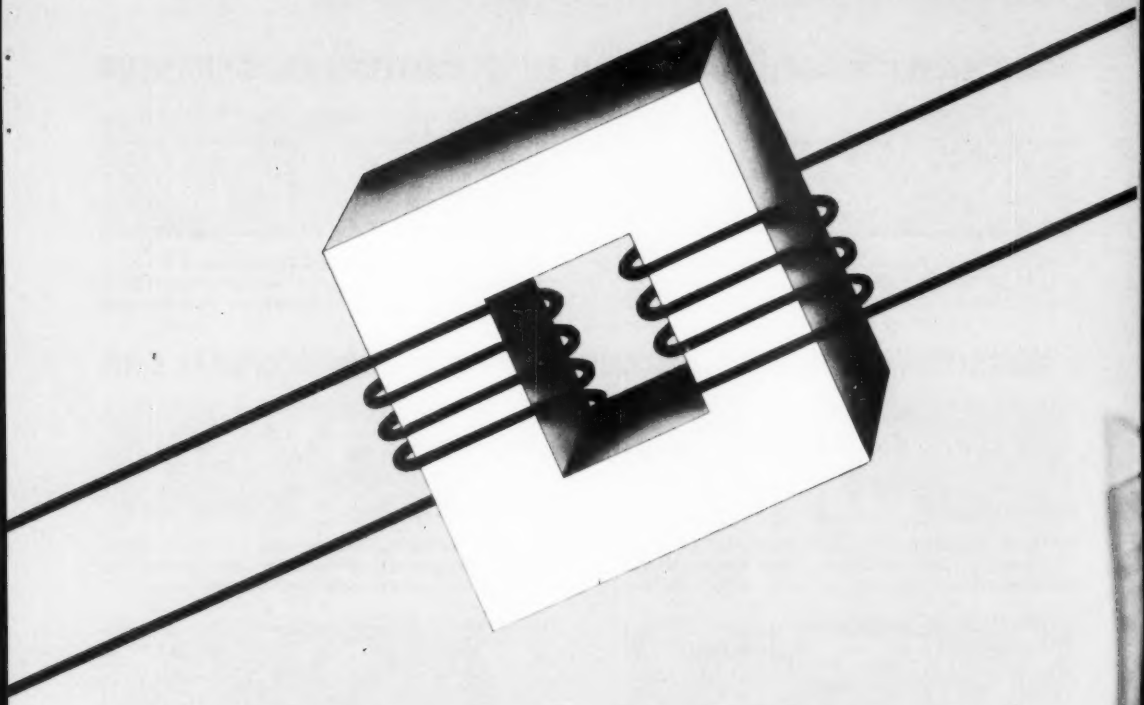
BYERS

CORROSION COSTS YOU MORE THAN WROUGHT IRON

WROUGHT IRON

TUBULAR AND HOT ROLLED PRODUCTS

ELECTRIC FURNACE QUALITY ALLOY AND STAINLESS STEEL PRODUCTS



Power's Handbook on

TRANSFORMERS

By J J O'Connor, Associate Editor

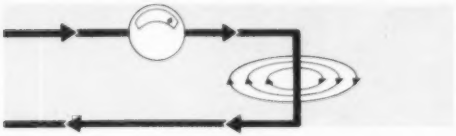
We're all rather inclined to take for granted the versatility of ac electric systems. And so we're also apt to take transformers for granted. Yet this essentially simple device, which was first introduced in this country well over 60 years ago, is the prime source of most ac advantages. For these lie mainly in the easy and efficient voltage changes transformers make possible.

Then, too, the nature of the transformer makes it easy to take for granted. Most units sit quietly through years of satisfactory service. While it's a tribute to their reliability, this very freedom from trouble may allow engineers to live with antiquated distribution systems long after new equipment would be economically justified.

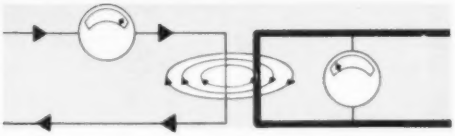
By adopting modern transformation practices, power engineers can often realize sizeable gains in plant flexibility, efficiency and reliability. To point the way, this special section, POWER's 82nd, boils down for you the practical essentials of putting today's transformers to work in your plant.

POWER • JUNE 1952 • P W SWAIN, EDITOR

TRANSFORMER PRINCIPLE: ENERGY CAN BE TRANSFERRED FROM ONE CIRCUIT

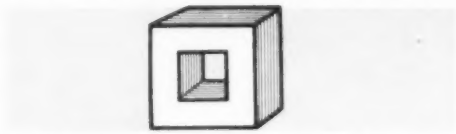


1 Similar to human breathing, magnetic field builds up and collapses each half cycle about any wire carrying ac. And, like ac, the field reverses its direction each half cycle

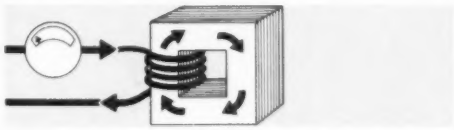


2 This "breathing" magnetic field will *induce* a voltage in any wire that gets in its way. Induced voltage is alternating, since flux field reverses direction every half cycle

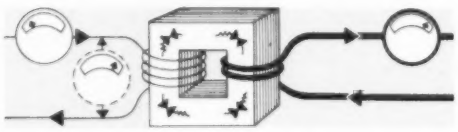
MAGNETIC FLUX WEAVING THROUGH THE PRIMARY AND SECONDARY COILS



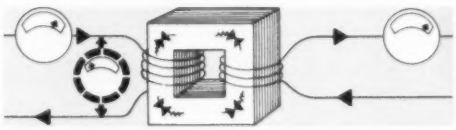
5 This is a basic core. It's made of thin steel sheets designed to reduce transformer eddy currents. Sheets are insulated from each other by varnish or an oxide film



6 Here's the input winding, or *primary*. It's insulated from and wrapped around laminated core. Magnetic flux in steel core induces voltage back into the primary coil



9 With transformer loaded, current in secondary turns produces new magnetic field that opposes mutual flux in core. This secondary flux tends to weaken mutual flux



10 When mutual flux tries to drop off, counter voltage in primary decreases. Then main impressed voltage pushes more current through transformer primary to fill up gap

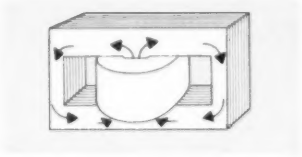
How Transformers Work...

Transformers — simple static devices — transfer ac energy from one circuit to another, usually at different voltage. This energy transfer is made magnetically through a steel core. In common 2-winding transformers there is no electrical connection from input to output.

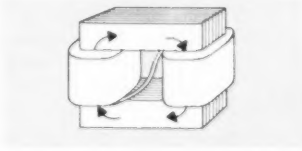
Transformers change voltage in direct proportion to the ratio of input to output turns. Units can be *step-up* — going from lower to higher voltage — or *step-down* — going from higher to lower voltage.

The terms *primary* and *secondary* refer to input and output windings, respectively. Input side is always primary side regardless of relative voltage values.

ACTUAL TRANSFORMER

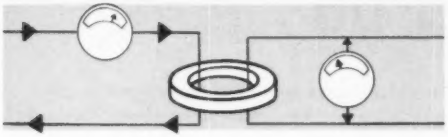


SHELL-TYPE core construction has legs of steel circuit outside windings. This construction often used in transformers having three or more separate windings

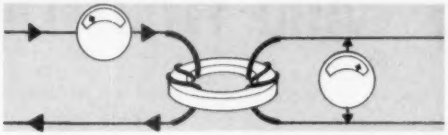


CORE-TYPE construction has the windings surrounding steel core. Actually there is little difference between shell and core types. Manufacturers today use both

TO ANOTHER BY LINKING CIRCUITS MAGNETICALLY THROUGH A STEEL CORE

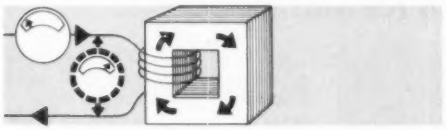


3 Since air is a relatively poor conductor of magnetic flux, next step is to add a steel magnetic runway to link both wires, making induced voltage a little higher

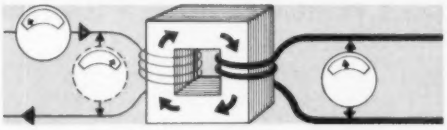


4 Increasing number of input turns permits higher input voltage or lower current without increasing core flux. Output voltage varies as number of output turns on core

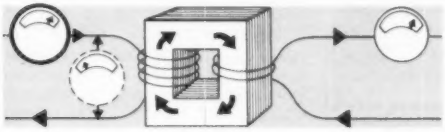
ACTS AS GOVERNOR, MATCHING TRANSFORMER'S INPUT TO OUTPUT WATTS



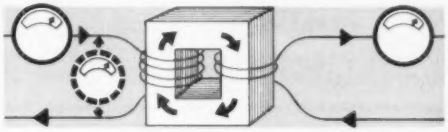
7 This induced *counter voltage* in primary opposes the main *impressed voltage*. Since counter voltage almost equals main voltage, the primary current is kept down low



8 Now *secondary* or output winding is added, and same flux induces voltage in it. Ratio of counter to secondary voltage equals ratio of primary to secondary coil turns

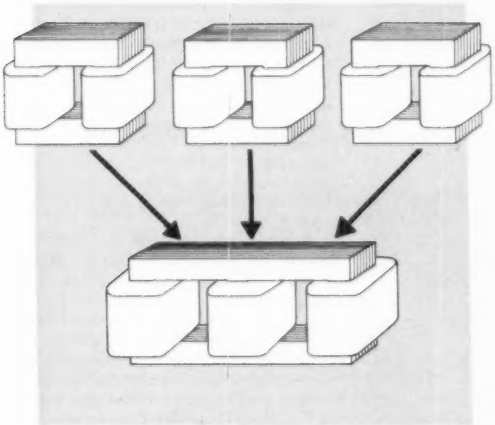


11 Greater primary current builds up core's mutual flux, compensates for secondary bucking flux. Result: watts output of secondary equals primary watts times efficiency

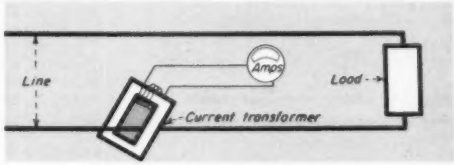


12 Primary current is fixed mainly by counter voltage, which varies with secondary load. Thus load changes reflect back to primary and mutual flux holds about even

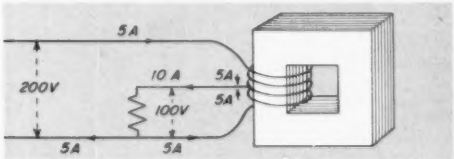
HAS PRIMARY AND SECONDARY ON SAME LEG TO REDUCE FLUX LEAKAGE



EVOLUTION of single-phase into 3-phase unit. End result uses about 10% less active metal. Some years back most 3-phase installations used three separate units plus one spare. Trend today is toward use of single 3-phase unit



CURRENT TRANSFORMER for metering, relaying, has primary in series with load. Secondary current is less than, but proportional to, that in primary. Thus low-voltage instruments and relays safely handle heavy or high-voltage loads



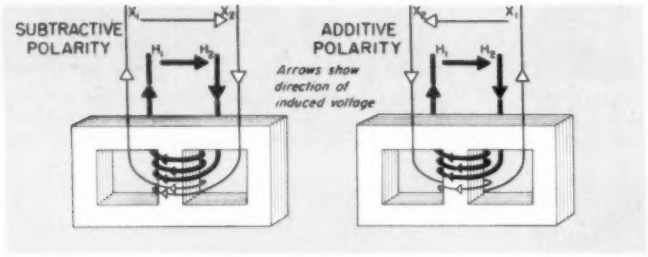
AUTOTRANSFORMER uses same winding for primary and secondary. Load current passing through top section of winding boosts flux in core. This raises voltage in winding's lower section. It too can then feed current into the load

. . . And What They'll Do

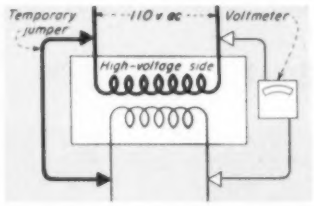
There are scads of transformer connections scattered through the many good texts in electrical engineering. So we're not going to duplicate all that info here. But we have sketched very simply some of the everyday connections to give the uninitiated an appreciation of what transformers will do in theory and in practice.

And, to make the picture as complete as possible, we probe, although lightly, into such matters as transformer heating, supply-voltage frequency and winding impedance, just to mention a few.

THESE PRINCIPLES HOLD WHEN CONNECTING FOR VOLTAGE CHANGE . . .



KNOWING POLARITY is key to connecting transformers. Polarity mark refers to direction of induced voltage in transformer leads as brought outside case to terminal strip

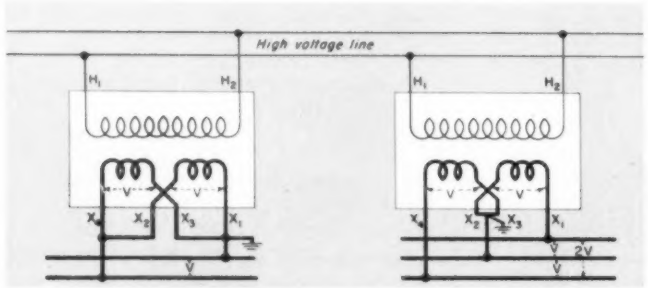


POLARITY TEST: Voltmeter reads less than 110 — subtractive; more — additive

TAGGING COIL LEADS

Transformer-winding leads are marked to show polarity, tell high- from low-voltage side. Primary and secondary are not identified as such because which is which depends on input and output connections.

High-voltage side is marked H. Thus each lead and tap is H_1, H_2, H_3, etc. Low-voltage leads are tagged X. Each lead and tap is then X_1, X_2, X_3, etc.



SINGLE-PHASE transformation showing, *left*, secondary winding in parallel splitting load between two sections, and, *right*, 3-wire system giving two voltage levels

Understanding polarity is first step in connecting transformers. Working diagrams, *left*, will help you apply intelligently most connection diagrams met in practice. But you might have to use a transformer on some job it wasn't meant for . . . and fast too. Or you might get a change in supply voltage or frequency. If these situations arise, watch the following points.

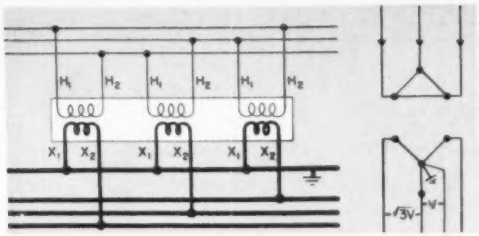
Temperature Limits. Copper loss shows up as heat in windings, and heat must be dissipated. In liquid-filled units, the liquid absorbs heat from windings and transfers it to cooling surfaces. Air does similar job in dry-type units. Final coil temperature depends on (1) rate heat is generated, a function of copper loss (2) area of coil surface exposed to liquid or air (3) speed of coolant circulation (unit with high viscosity oil runs hotter than one with low) (4) condition of heat-dissipating surfaces.

Transformer operating limits tie closely with aging of transformer insulation (see p 80). Useful life depends on time required for insulation to lose its mechanical strength. Aging occurs at all temperatures, but rate doubles (life halved) for about each 10-C increase. If a transformer usually operates at light load and low temperature, it can work for short times at high load and temperature and still have good insulation life.

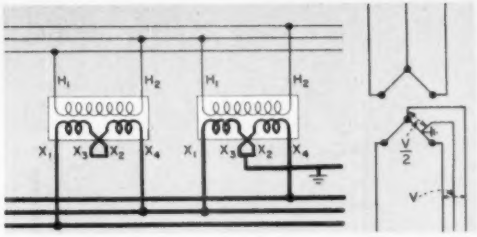
Voltage and Frequency. Here are a few general suggestions on using transformers for voltages and frequencies other than those they're rated at:

1. It's safe to increase supply frequency if supply voltage is held constant. If voltage rises significantly, transformer may overheat. Normal current can be carried in this case; there's no need to reduce kva rating.

2. Supply frequency can be dropped if voltage is lowered proportionately. This leaves flux density the same. Lower frequency cuts iron loss and exciting current. It's generally safe to use a



DELTA-WYE connection used widely for 208/120-v plant distribution. Small 3-phase power loads connect across 208-v line



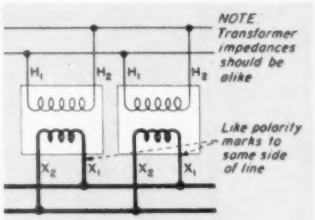
OPEN-DELTA hookup for small power demands. Half of line-to-line voltage available between two line-wires and the neutral

60-cycle transformer on a 25-cycle circuit if voltage is dropped to about half of normal. Naturally, kva output will also be halved.

3. Input voltage can be decreased at normal frequency. With normal current, this will drop kva output in proportion to voltage drop. But frown on upping voltage input at constant frequency; core and coil losses too high.

Impedance. Transformer impedance is combined effect of resistance and reactance. You can measure percent impedance by measuring primary voltage needed to force full-load current through secondary with secondary short-circuited. Result is expressed as a percentage of rated primary voltage.

If transformers are hooked in parallel, impedance, hence voltage drop, must be about the same in paralleled units for successful operation.

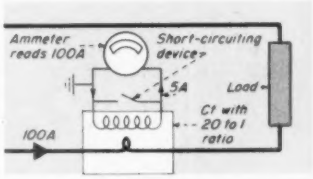


PARALLEL OPERATION, two single phase transformers. Note polarity markings

...FOR MEASURING CURRENT

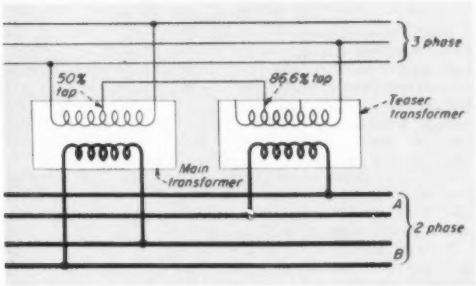
All transformers change voltage. But some change current values for metering and relaying, *sketch, right.* These are current transformers (ct's). Relation between primary and secondary voltages and currents is same as in voltage transformers. Ct secondary is generally designed for 5 amp with primary carrying full-load current.

Don't open ct secondary circuit while primary carries current. Close short-circuiting switch on ct itself. Otherwise, open-circuit secondary voltage in some ct's may build up to a value dangerous to you and the insulation. This happens because no bucking flux opposes mutual flux linking primary and secondary. Secondary voltage depends on core flux, a function of primary current. With no opposition from secondary winding, mutual flux will soar when any sizeable primary current flows.



CURRENT transformer isolates high voltage, chops down current to be measured

...FOR PHASE TRANSFORMATION



SCOTT CONNECTION changes 2-phase to 3-phase voltage. Needs two transformers having 50% and 86.6% tap on 3-phase side

Giving Transformers a Name

Transformers are generally classed by use:

Power transformers are used in generating plants to step up voltage and in substations to step down. They're large—over 500 kva.

Distribution transformers step down to 600 or 480 v for industry or 240 and 120 v for residential, commercial use. They range in size from 1.5 to 500 kva.

Instrument transformers—potential and current—serve low-voltage meters, relays.

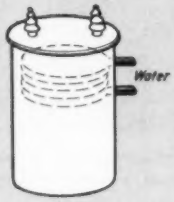
Specialty transformers include all those changing voltages for specific applications: signs, arc lamps, bell ringing, etc.

MODERN POWER TRANSFORMERS BOAST ADDED COOLING METHODS, TRIPLE

OA

Coils immersed in oil-filled tank whose surface is smooth, corrugated or tubular

OA



OW

Cooled by water coils placed in the oil

OW/A

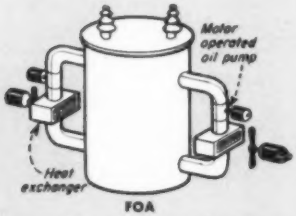
Tubes for self cooling plus water coils

OA/FA

Double-rated: Self and forced cooling

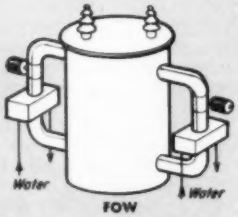
OA/FA/FA

Triple-rated: Self, 2-stage forced



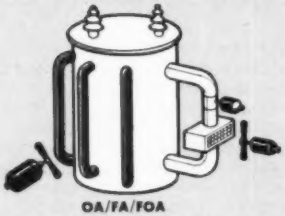
FOA

Oil pumped through fan-cooled exchanger



FOW

Water, not air, cools heat exchanger



OA/FA/FOA

Fans play double role for triple rating

Liquid Filled

Transformers may be classed *wet* or *dry* according to the medium used to absorb heat from the coils. In the wet type, liquid serves a dual role — as primary heat-transfer medium and as insulation. Mineral oil does these jobs well but it's a fire hazard. Non-flammable synthetic liquids have thus been developed to permit indoor installation without need for building a vault. The liquid-filled type predominates in sizes over 500 kva.

COOLING LIQUID-FILLED UNITS

Heat is limiting factor in transformer loading. For liquid-filled types, removing coil heat is 2-stage operation. In simplest case, coils are immersed in a smooth-surfaced oil-filled tank. Oil picks up coil heat, transfers it to tank surface, which gives it up to surrounding air. For units 25 kva and larger, size of smooth tank needed to dissipate heat becomes larger than needed to enclose coils. So tank may be corrugated to add surface, or external tubes may be welded to tank.

To further boost heat-disposal capacity, air may be blown over the tube surface. Higher air velocity makes each square foot of surface work harder. Such designs are called *forced-air-cooled*, in distinction to *self-cooled* types.

A forced-air-cooled transformer with two sets of fans may thus have three ratings: (1) self-cooled (2) with one set of fans (3) with all fans working. This is called a *triple-rated* transformer. High velocity fans can increase top rating to 1.67 times the self-cooled rating.

To a declining extent, water is used as a cooling medium.

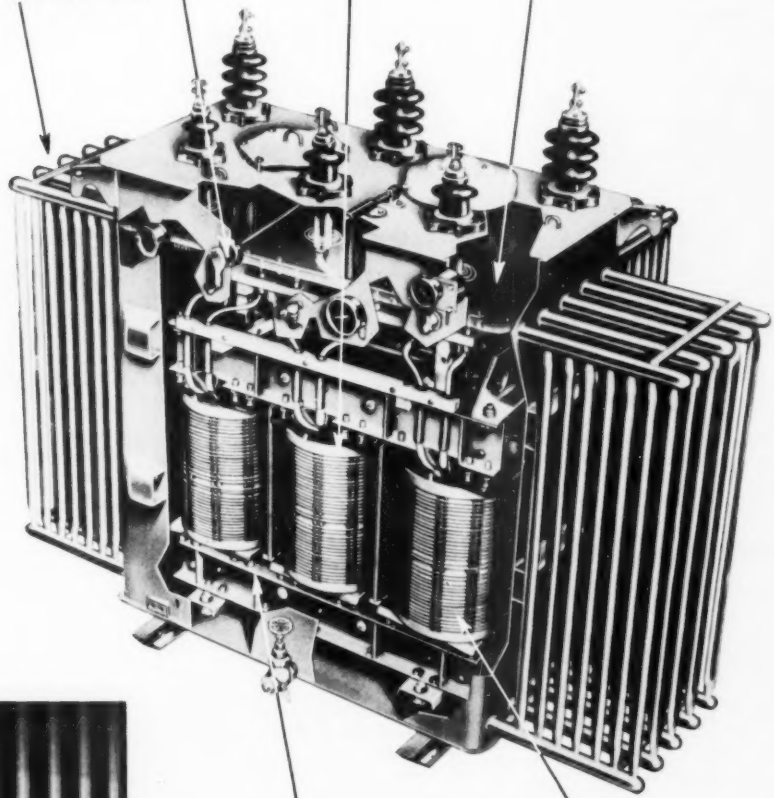
RATING, SEALED TANKS, REDUCED PHYSICAL SIZE PLUS BETTER INSULATIONS

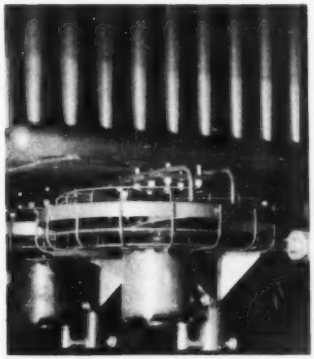
TAP CHANGER. In this unit taps can be changed only when transformer is disconnected from line. Under-load tap changers available

COOLING. This type transformer is available with many of the cooling systems shown on facing page. Typical are self-cooled, water-cooled, and self-cooled / forced-air-cooled

COIL ASSEMBLY. Coils are mounted on heavy pressboard cylinders. Low-voltage coils are insulated from core by an array of pressboard tubes. High- and low-voltage windings are suspended concentrically by one or more pressboard cylinders. Winding-ducts aid cooling

OIL PRESERVATION. Variety of oil-preserving methods are used (p 79). Units of 10,000 kva and under are air-sealed to prevent breathing and moisture entry. Larger units seal nitrogen above oil instead of air. Size division between air seal and inert gas varies with manufacturer. Conservator type is also widely used





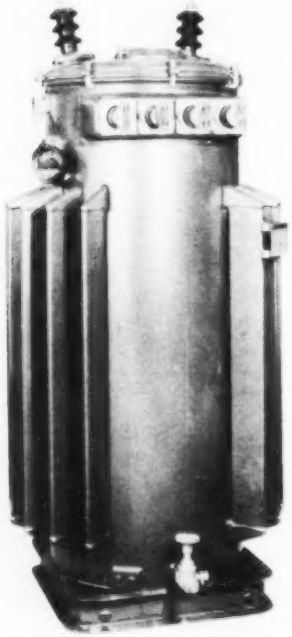
PROVIDE for air-blast equipment when selecting; add when load warrants it

CORE FORM. This type transformer core is made up of electrical-steel laminations of stepped width, thus making approximate circular section

WINDINGS. All conductors insulated with oil-impregnated paper. Taps come out in middle of windings to keep away from end surges

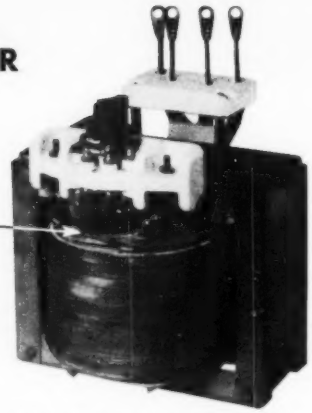
POWER TRANSFORMERS CAN BE BROUGHT INDOORS BY USING ASKAREL FOR OIL, OR DRY-TYPE UNIT ➡

TYPICAL DISTRIBUTION TRANSFORMER



SEALED TANK keeps dielectric strength of oil up and prolongs insulation life

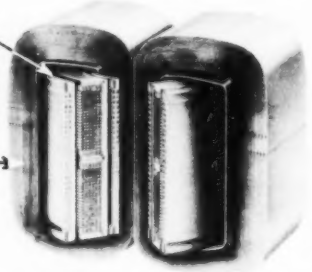
PAPER INSULATION between layers of coil on smaller units pretreated with resin varnish. Heating softens varnish to flow around conductors. When cooled, thermo-plastic element hardens and sets, bonding conductors and the coil insulation



IMPULSE STRENGTH held high by sucking air and moisture out before adding oil

OIL DUCTS are formed by vertical spacers between the concentric coil windings. Ducts aligned in direction of natural convection currents

CORE SECTION forms rough circle. In manufacture, core steel is first wound on mandrel in rectangular form to match shape of coils. It's then annealed and cut into separate two-turn sections which are individually laced into rectangular form



TOP EDGES of paper insulation folded over winding layer hold conductors snug

NON-FLAMMABLE ASKAREL FLUID CUTS FIRE HAZARD

Back in the early 30s a non-flammable insulating and cooling liquid, askarel, came into the transformer picture. It has been used in place of oil to eliminate oil fires traced to transformer failures. This fluid costs more than oil. But added expense is often justified since (1) unlike oil filled, askarel units can be installed inside buildings without separate vaults, (2) they are insurance against possible fires.

Non-flammable liquid-filled units aren't final answer to explosion hazard. As long as liquid is used, danger exists of tank rupturing from internal pressure. This pressure is the result of arcing or overheated wires in the liquid.

Although we mention the fire and explosion hazard, service records show actual occurrence is rare in practice.

Fifty years ago, transformers with efficiencies of 90% were pointed to with pride. Now 99.5% efficiencies are met every day. Improved core material and insulation have contributed much to this amazing increase.

Core Construction. About 50 years ago, silicon steels were introduced to lick the aging problem (magnetic characteristics varying with time). As these hot-rolled steels improved, core flux densities went up, and core sections were reduced, meaning less core steel. With smaller core sections, shorter copper turns were needed; a second material saving. Finally, smaller frames and tanks reduced overall size and cost.

The next big step core-wise was the development in the '30's of grain-oriented cold-rolled silicon-steel alloys. The steel's magnetic crystals are lined up in direction of rolling, giving flux smoother path to follow. This contrasts with random crystal pattern in ordinary silicon steels. Once again flux density could be raised, size and material reduced.

Insulation. Older distribution-transformer windings were generally impregnated with high-dielectric-strength solid gum. But gums had a low impulse strength and softened under heat, contaminating the oil. Little was known about lightning surges and impulse strength of materials then. But development of the surge recorder, cathode-ray oscillograph, and surge generator led to better understanding of voltages a transformer will meet and must withstand in operation. As a result, varnish and shellac came into the picture. They combined high dielectric strength and high impulse strength. In addition, they stood up well under heat.

At the same time, sealed-tank construction appeared that lengthened life of oil in liquid-filled units. This also eliminated cost and nuisance of separate handling and shipping. Units could be filled in manufacture. These steps, coupled with today's long-lived outside-tank paints, make the maintenance-free transformer a close reality in many cases.

LONG TRANSFORMER LIFE HINGES ON...

Modern liquid-filled transformers have long life expectancy. Two major contributors to this endurance are today's methods of oil preservation, and the winding protection built in by the manufacturer. Both will be discussed below. But first, the operating engineer should know how to prolong oil life in existing transformers by using oil inhibitors.

At present, several transformer manufacturers recommend adding an inhibitor to used transformer oils. This slows oxidation and general deterioration of the oil.

Before adding an inhibitor, oil should first be filtered and tested for acidity and interfacial tension. Amount of inhibitor added depends on results of these tests. Clean the coils, core assembly and inside of tank, then return oil, add inhibitor and agitate. Natural circulation will further mix oil and inhibitor in service.

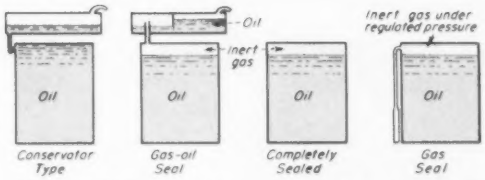
...PRESERVING THE INSULATING OIL

Improving transformer cooling methods tended to raise oil's operating temperature. Oils that did a good job at lower temperatures aged quickly at higher ones. Highly refined insulating oils commonly used 25 years ago tended to form acids more readily than less-refined oils. But latter group was more likely to form sludge. So by carefully selecting crude-oil source and controlling refining, a reasonable compromise resulted. Later study showed oxygen and moisture as principle causes of oil deterioration.

For these reasons, the *free-breathing* type of transformer was largely superseded by the *conservator* type. These transformers breathe through a small auxiliary expansion tank of cold oil. This reduces absorption of oxygen and moisture to a minimum, retards sludge formation.

Sketch shows other methods of oil preservation: complete sealing with nitrogen filling space above oil, gas seal formed by a cushion of nitrogen under regulated pressure (gas pressure maintained in space above oil), gas-oil seal with pressure in gas space above oil maintained by head of oil in an auxiliary tank.

A more recent step in oil preservation is use of an oil-conditioning unit built on transformer tank wall. Natural circulation sends oil through filtering medium.



OIL PRESERVATION methods have common aim: to keep hot oil and air separated. Note the methods using inert-gas blanket

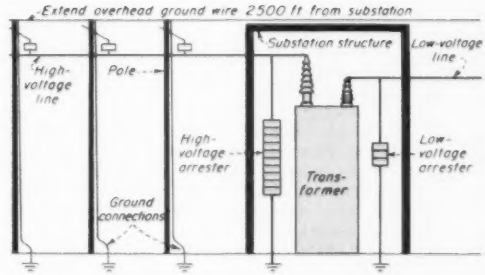
...PROTECTING THE COIL WINDINGS

There are two sides to transformer-winding protection. First comes surge-voltage or lightning protection. And then the ever-present need for guarding against overloading.

Transformer-winding insulations are often stressed to higher than normal operating voltages. Over-voltages come into the picture when lightning strikes lines or when voltages surge because of switching. A practical way to limit these peaks is with lightning arresters or spark-over gaps, connected between line and ground. Then when lightning strikes, arrester or gap breaks down, giving a low-impedance path to ground for the surge current.

But arrester must not break down at normal operating voltage. And, on the other hand, transformer insulation must stand up under surge voltages permitted by arrester.

Trend in today's distribution transformers is to incorporate complete protection – that is, against lightning, overloads and short circuits – into the transformer. This means (1) lightning arresters (2) protective links in series with high-voltage leads to protect feeder against short circuits that might occur in transformer winding (3) circuit breaker in secondary to protect windings against overloads and short circuits. Secondary breaker is generally operated by a bimetallic element submerged in the same oil with the transformer windings and carrying the same current. Combination of oil temperature and actual current produces a temperature in the element similar to that in the transformer winding. Hence circuit breaker operation is controlled by this simulated winding temperature rather than by magnitude of the current alone.



LIGHTNING ARRESTERS connect as in above typical diagram. Built-in overload protection is available in some designs

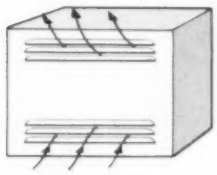
Dry-Type Units

Oil-filled transformers are efficient low-cost low-maintenance units. But because of fire hazards, they must be put outdoors or in a fireproof vault.

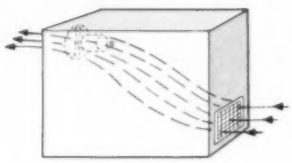
This proves a drawback for industrial-plant application. Trend today is toward locating transformers and associated switchgear (usually as "packaged units") at load centers in the plant. This is in contrast to former practice in which step-down transformers were placed outside and long low-voltage feeders ran through the plant to points of use.

Use of non-flammable askarel in place of oil is one solution permitting transformers to be used inside the plant at load centers. The "dry-type" design forms another answer. Let's first take a look at dry-type construction, then consider pros and cons of askarel and dry types in following pages.

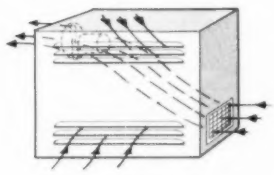
DRY TRANSFORMERS CAN BE SEALED OR VENTILATED



AA
Self-cooled unit, open or sealed



AFA
Forced-air-cooled, no self-cooling



AA/FA
Combined self- and forced-cooling

INSULATION TODAY...

Electrical insulating materials offer a high resistance to flow of electric current. Their job is to guide current and keep it on its proper path along conductors. Temperature limits of insulations form an important factor in rating any piece of electrical equipment. Permissible operating temperature depends on class of insulation used. For instance:

Class O insulation consists of cotton, silk and paper, when these are not impregnated or immersed in a liquid dielectric. Limiting hottest-spot temperature is 90 C.

Class A is made up of (1) cotton, silk or paper impregnated or immersed in liquid dielectric (2) molded and laminated materials with cellulose filler, phenolic and other resins (3) films and sheets of cellulose acetate and other cellulose derivatives having similar properties (4) varnishes and enamels applied to conductors. Limiting hottest-spot temperature is 105 C.

Class B uses mica, asbestos, fiberglass with organic binders. Hottest-spot temperature limit is 130 C.

Class C consists entirely of mica, porcelain, glass, quartz, similar inorganics. Temperature limit isn't set.

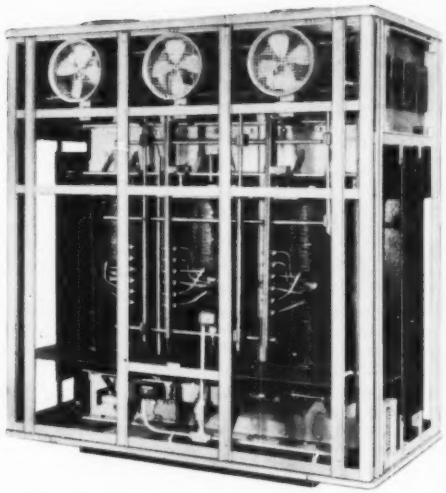
Class H, newest member of family, includes (1) mica, asbestos, fiberglass with silicone compounds as binder; (2) silicone compounds in rubbery or resinous forms. Industry standards set 180 C as limit, Navy specs list 200 C.

The air-blast transformers that were widely used years back, especially in street-railway work, might be considered forerunners of today's dry-type units. The modern designs, however, made their formal bow to industry in the early 1930's. These units use air or an inert gas as the medium for removing heat from the transformer coils. In open, ventilated designs, air does the job. The advent ten years ago of sealed design brought inert gases like nitrogen into the picture.

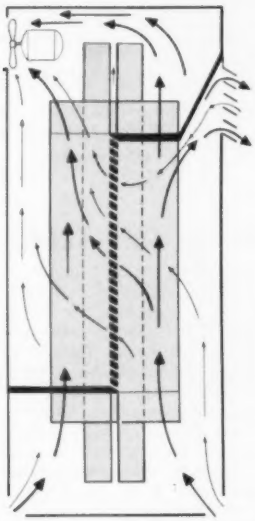
Ventilated dry-type transformers with Class B insulation have been widely used for years. But their application has often been limited to the clean, dry indoor locations. During World War II, many went into plants where they were exposed to some moisture, dust, lint, or corrosive fumes. Even though these atmospheric conditions weren't ideal, vented Class B's did well. In such cases, precautions are necessary to prevent moisture entering windings during shutdown. Accumulated dust and lint must be removed from windings periodically. Outdoor installation for this type unit is definitely unsound because rain and wind push moisture into windings. A typical ventilated design is illustrated above.

Sealed Units. The newer sealed de-

FANS EXTEND RATINGS BEYOND THOSE POSSIBLE WITH NATURAL DRAFT



AIR BAFFLE channels air flow. When the temperature reaches overload level, fans draw air through spaces between coils



NATURAL DRAFT (heavy arrows) draws air from base through core. Induced cooling (light arrows) for overload conditions

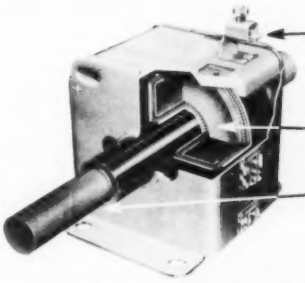
signs promise much in the industrial-plant picture. Among the advantages of sealed-in-nitrogen construction are: (1) Little maintenance is needed. (2) Transformers can be installed in dirty locations provided periodic checks are made of bushings and gas pressure. (3) Units can be used where flooding is possible, and outdoors as well as indoors. (4) No contaminants are present to decrease insulation voltage strength. (5) Minimum oxidation means longer insulation life.

Class B Insulated. Sealed dry-type units generally divide into two groups: those using Class B insulation and those using Class H. Both insulation types are found in ventilated designs, also. Perhaps the most recent development in the Class B field are units, gas filled and sealed, claiming to do a Class H job with Class B insulation. Note from adjoining box that the maximum hot-spot temperature for Class H is generally considered 180 C, far above the 130 C normally considered the limit for Class B transformer insulations.

Materials for Class B insulation cost less than those for Class H. But recent research has shown that when Class B materials are sealed in nitrogen they can be operated at temperatures previously considered practical only with the more expensive Class H materials. Results of tests made by one major transformer manufacturer, for example, reveal that Class B materials in a sealed nitrogen atmosphere can be operated at Class H temperatures with life expectancy equal to or greater than Class B insulations operated at lower temperatures in ventilated construction.

Class H Insulated. Insulation in the Class H group consists of inorganic materials such as glass, porcelain, mica, asbestos, etc, bonded or impregnated by silicone resins or fluorocarbons. Thus difference between Class B and H insulations lies in the resins and varnishes used as bonds and impregnants. Class H transformers, preferably sealed in nitrogen, can be installed where extremes in loads, temperatures and atmospheric contamination must be met. Such designs show good promise in the industrial-power field.

CT WITH A REMOVABLE PRIMARY CONDUCTOR


SECONDARY terminals are solderless connectors that handle No. 14 to No. 6 wire. No short-circuiting device used; open-circuit volts only about 100 rms
RING-CORE is round, forming heart of current transformer's secondary winding
PRIMARY is a removable round conductor of silver-plated copper, held in place with snap rings. It can be removed or rotated to facilitate mounting ct

INDOOR-TYPE CT applicable to both single- and multi-phase low-voltage circuits. *Butyl*, one of the newer synthetics, is also being used for insulation in ct's

Putting Transformers To Work

Now that we know how transformers work and what types are available, let's turn to the questions of selection and installation. These go hand-in-hand — transformer location strongly influences the type chosen. So, most times, the first question is "Where will the unit go?" And this, of course, ties in with the kind of distribution system — low-voltage, from an outdoor substation, or high-voltage with load-center units in the plant.

Once you know what conditions your transformers must meet, you've pretty well settled what type they'll be. Then comes consideration of details.

POINTERS ON SAFE TRANSFORMER INSTALLATION

By far the biggest kva volume of transformers are oil filled. When properly applied and maintained, the fire hazard is slight. Yet it must be considered. Fires in oil-insulated units can be intense, damaging not only unit itself, but endangering surrounding equipment and buildings. Fire can result from overload or from insulation breakdown caused by: switching, lightning surges, gradual deterioration of insulation, low oil level, moisture or acid in oil, failure of insulating bushing. Arcing that follows vaporizes oil and may create enough pressure to blow off cover or rupture casing. If this happens, oil may be ignited, belched out, and wind up as a flowing fire. That's why it's wise to put oil-filled transformers outdoors.

For outdoor installations of oil-filled units, fire hazard is minimized by setting transformer on concrete base having a curb at least 6-in high around edge. If possible, base should extend at least 3-ft beyond transformer in all directions. Fill basin thus formed with coarse crushed stone. Be sure to provide a drain.

Small outdoor oil-filled units can be mounted on poles in the yard or on brick or concrete walls, preferably between windows. It's also best to have adjacent windows glass-wired in steel frames as a fire protection.

Protect important oil-insulated transformers with fixed extinguishing systems manually or automatically operated. Either water spray or carbon dioxide fills the bill. Water spray is suited for transformer fires since it will not carry current, and its cooling action protects adjoining buildings. Solid water streams from hoses are not safe to use on high-voltage equipment. Carbon dioxide is particularly well suited for use on vault transformer fires. Confined CO_2 is concentrated and effective.

Indoor installations. Install indoor oil-insulated units of over 600 v in fire-resistant vaults and provide extinguishing systems. Walls and roof of vault should be reinforced concrete at least 6-in thick, brick at least 8-in thick, or load-bearing tile at least 12-in thick. Coat inside tile walls with cement plaster.

Askarel. This non-flammable liquid can only be used in transformers designed for it. Although permitted in any outdoor location, indoor units rated 15 kv or higher must be put in vaults for high-voltage protection.

Indoor askarel units rated over 25 kva should have pressure relief vent, may be connected to a flue running outdoors. Flue will handle chlorine gases generated by accidental arcing. The flue can often be left out if a gas absorber is installed on case. In a well-ventilated area, there may be no need for flues or absorbers, as the local inspector decides. The vent, however, must be present.

Dry-Type. In general, *ventilated* dry-type units don't need protective vaults indoors. With modern Class B or H insulations, the danger of fire is relatively small. With Class B vented units, however, windings must not be allowed to absorb moisture during shutdown. Strip heaters located in casing are often used when humid surroundings warrant. They start heating automatically when the transformer shuts down.

Good ventilation is a must for cooling this type transformer. Guard against accidental water entry from open windows, possible breaks in steam or water lines. Filter transformer air if necessary. If units are installed in restricted spots, provide enough forced ventilation to hold air temperature within specified limits as measured at transformer inlets. Volume of air generally needed is *100 cfm per kw of transformer loss.*

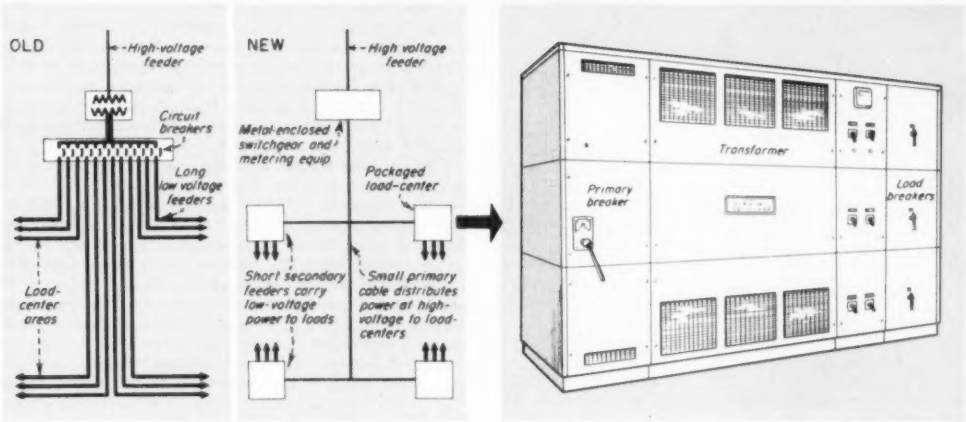
The *sealed* dry-type, with either Class B or H insulation, can be used any place regardless of atmospheric or moisture conditions. They can also be used where flooding is expected or in dirty industrial locations. Site can be chosen, too, without concern for people since core and coil elements are hermetically sealed in dry nitrogen. The possibility of explosion is eliminated.

SELECTION: OPEN DRY-TYPE OR ASKAREL

	Dry	Askarel
EXPOSURE TO LIGHTNING		
1. Where transformers connect directly to lightning-exposed circuits with only usual lightning protection	No	Yes
2. If lightning exposure is negligible or if unit is suitably protected, if feeder cable is underground, or if overhead supply having usual lightning protection feeds into primary cable at least 1500 ft long	Yes	Yes
LOCATION AND ATMOSPHERIC CONDITIONS		
1. Relatively clean atmosphere: assembly plants, etc	Yes	Yes
2. Bad atmosphere: foundries, cement, flour mills, etc	No	Yes
3. Areas of high humidity or of possible flooding	No	Yes
4. Acid, oil or corrosive vapors present	No	Yes
5. Units to be installed in hazardous locations (see National Electrical Code, article 500)	No	Yes
6. Transformers to be overhead on platforms or roof trusses, all other conditions being satisfactory	Yes	No

Note: In general, the sealed dry-type transformer can be used under all the above conditions that would rule out ventilated dry-type units

HOW LOAD CENTERS PAY OFF IN INDUSTRY



LONG CABLE-RUNS carrying secondary voltage can be avoided by running primary voltage right to load area in plant. There modern load-center equipment will step voltage down to utilization level and shoot it to load through short feeder lines

Load-center distribution means bringing primary power close to plant load instead of ending it at an outdoor substation. Development of askarel and dry-type transformers made load-center idea pay dividends.

These dividends start with installation. Cost of long runs of heavy secondary copper and conduit is cut by bringing smaller primary copper right to load. In a 2400/240-v system, secondary copper is 10 times heavier than primary. Too, short secondary feeders cut voltage drop and power loss in cables. Voltage angle alone is important for good motor performance and proper lighting levels.

When to Use. Load-center distribution with dry-type or askarel units is not always best bet. If secondary feeders are short, outdoor oil-filled units may be better. Here are a few rules of thumb: With a 120/240-v single-phase load, load center will generally pay off if transformer-to-load distance is above 160 ft for 25 kva load, above 90 ft for 75 kva load, and above 60 ft for 200 kva load. Following same pattern for a 480-v, 3-phase distribution system, load centers generally work best for 150 kva load more than 400 ft from transformer, 300 kva load above 300 ft, 750 kva over 150 ft.

Modernizing. Can you use load-center principle in an old plant? Sure can. Let's say present system is overloaded from changes and normal load growth. Best way to raise distribution capacity may be to bring primary lines indoors, set up load centers. For instance, take the lighting load in a plant or office building. Often you can chop lighting feeders into smaller circuits, install askarel or dry-type transformer at center of each circuit, run primary voltage to each transformer.

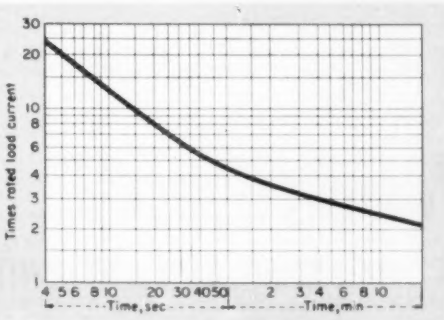
Packaged Equipment. The use of packaged equipment goes hand-in hand with load-center principle. Trend today in selecting a substation – whether indoors or outdoors – is to buy unitized packaged equipment incorporating all basic components into one. This means that switchgear, buswork, transformer are all factory assembled, simplifying greatly the job of buying and installing.

EMERGENCY LOADING

Temperature is the limiting factor in transformer loading. Heat affects life of winding insulation and oil when it's used. The hottest-spot temperature is result of four factors: (1) ambient temperature, (2) average oil temperature rise over ambient, (3) average copper temperature rise over average oil temperature, (4) hottest spot copper temperature over average copper temperature. If any one or more of these four can be lowered, insulation will be cooled, additional load may be carried.

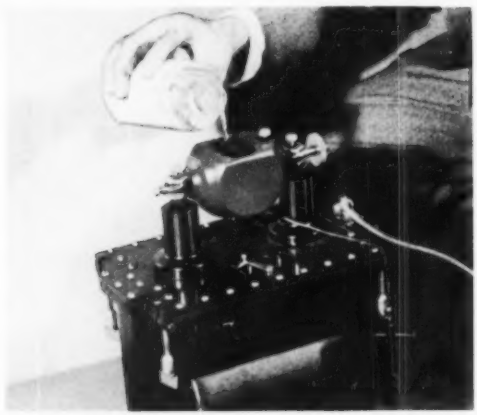
Fans blowing on tanks and tubes drop oil temperature, allowing up to 30% load rise. Fans brush off air film clinging to surface of radiator, improve heat transfer.

In emergency, if temporary cooling is needed fast, water spray on tank and tubes is very effective. Almost any self-cooled transformer can have its output increased about 67% by effective use of water-spray technique.



SHORT-TIME OVERLOADS permissible for oil-filled self-cooled transformers 200 kva and below using 30-C cooling air

LIQUID-FILLED



FILL TEST CUP from sample bottle. Then gradually build up voltage and note breakdown point — 22 kv or better, OK for oil

Most books emphasize manufacturer tests. For the operator, most important routine check is for liquid's dielectric strength. Insulation readings may be taken but they're of most value during any necessary coil dry-out periods.

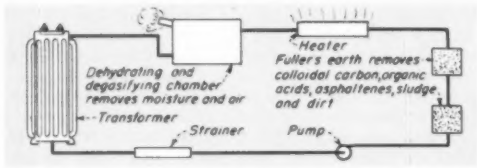
Oil Testing. Use a high-voltage test set. Dielectric strength of new oil should be at least 26 kv in standard test cup. If it isn't, don't add to transformer. Oil in service should stand at least 22 kv. Recondition if it doesn't.

Clean a large-mouth bottle thoroughly, rinse with nonleaded gasoline and dry. Use a cork stopper. You'll need about a pint sample. Take it from valve at unit's bottom.

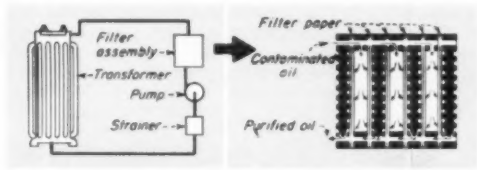
Fill spark-gap test cup from sample bottle. Allow oil to settle for about 30 sec. Then increase test voltage at rate of about 3000 v per sec, until oil breaks down. Make five "breakdowns" on each sample filling. Empty test cup and refill with fresh oil from sample bottle. Average breakdown voltage of 15 tests (five on each of three fillings) is a true measure of dielectric strength.

Askarel Testing. Where possible use separate test sets for oil and askarel. Askarel is heavier than water; moisture rises to top. So take samples from both top and bottom. Use but one "shot" per filling. Refill at least five times, average results. Filter askarel when it tests under 25 kv.

RECONDITIONING THE LIQUID



OIL-PURIFYING components shown above are really packaged as one unit. Can be used with transformer in normal operation



OIL FILTER removes moisture and sediment by forcing the used oil through several layers of clean oven-dried filter paper

In presence of oxygen, heated transformer oil oxidizes. Objectionable products — acids and sludges — gradually form. Acids in combination with moisture are a cause of internal corrosion. Sludges interfere with heat transfer.

Whether used oil is replaced or reconditioned depends on economics. There are many methods of conditioning. They usually involve one or more of the following operations: centrifuging, mechanical filtering, chemical treatment, and adsorption.

Filter presses and centrifuges, alone or in combination, are commonly used. Both remove moisture and sediment. Acids, esters and other oxidation products can be removed by treatment with alkalis or mineral acids. Drawback is the tough job of getting rid of last traces of alkali or acid. If allowed to remain, they speed deterioration when the oil goes back into service. Thus chemical treatment isn't generally used except where needs justify elaborate equipment able to simulate refinery methods on a small scale.

Activated clay, alumina, silica gel and carbon serve as mechanical filtering mediums and also, by selective adsorption, remove acids, colloids and moisture.

Askarels are usually conditioned by mechanical filtration, by adsorption, or both.

Maintenance . . .

. . . OF LIQUID AND DRY UNITS BOILS DOWN TO KEEPING INSULATION TIPTOP

Every transformer maintenance plan should include checks on oil level, insulation resistance, bushings and tank. Many plant men make these checks every 6 months. But scheduling depends on individual operating conditions and on steps transformer designer took to reduce maintenance.

Maintenance operations fall into two broad groups: (1) checking insulation separating electrical circuits

DRY-TYPE

For dry transformers, the maintenance approach is a little different. There is, of course, no need for testing liquid dielectric strength or reconditioning liquid. If a dry unit is completely sealed there is little maintenance outside of external cleaning, insulation-resistance testing and checking inert-gas pressure. So let's line up our sights on the open ventilated types, where there's somewhat more to think about from the maintenance angle.

INSPECTION

Inspect units in clean areas annually. In dirty locations, clean at 3- or 6-month intervals. First few inspections will give you a line on what interval is needed.

With transformer off the line, take down unit's removable covers. Inspect for dirt, especially on insulators or where it may restrict air flow. Check for loose connections, condition of tap changer and terminal board, signs of overheating or voltage creepage over insulating surfaces. Tracking or carbonization reveal the last. Look also for signs of corrosion. Inspect fans, motors, auxiliary devices. Check settings of thermal relays.

Clean windings with vacuum, blower, or compressed air. It's best to use vacuum cleaner first, then follow up with compressed air or nitrogen (keep pressure about 25 psi). Brush or wipe clean all lead supports, tap changers, terminal boards, bushings, etc. Steer clear of liquid cleaners, some have a solvent effect on insulating surfaces.

TESTING

Before putting any dry transformer in service (1) measure insulation resistance (2) run a high-voltage test at 75% of factory test values. These checks tell whether unit is ready to go and give data for future comparison.

Insulation-resistance test indicates whether unit is clean, dry and suitable for application of high-voltage test. So make insulation test before the high-voltage check. As a guide, consider 2 megohms per 1000 v of nameplate rating as a satisfactory "go-ahead" for the high voltage test. Take megohmmeter reading at end of one minute at 25 C. Check this point with the transformer manufacturer for more specific values.

In addition to the above, the following tests are sometimes made: (1) ratio tests for full windings and for all tap positions (2) measurement of winding resistance (3) polarity (4) power factor of insulation. For details see *Standard Handbook for Electrical Engineers.*

DRYING THE COILS

You may need to dry-out a transformer before installation, or after an extended shutdown under humid conditions.

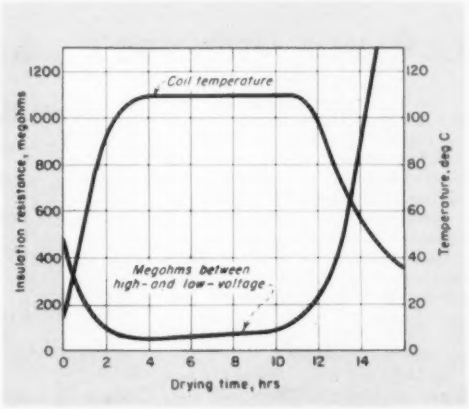
First blow or wipe off free moisture. For dry-out, use external or internal heat, or both. External is preferred.

To dry with external heat direct heated air into transformer's lower air inlets, place core and coil assembly in a non-flammable housing with openings at top and bottom to circulate air, or use a regular ventilated oven.

It's important for most of heated air to pass through winding ducts, not around sides. Good ventilation avoids condensation in transformer itself. Supply air enough to keep inlet and outlet temperatures roughly equal. Resistance grids or space heaters serve for raising air temperature. Place these within case or housing, or outside with fans blowing air in. Protect core and coil assembly against direct heat. Don't let air exceed 110 C for Class B insulation.

To dry with internal heat, short-circuit one winding and apply voltage to other until approximately normal current circulates. This is slower than external heating.

Drying time depends on transformer size, voltage, amount of moisture absorbed, drying method. Plot insulation-resistance curve as a guide (*sketch, right*). Keep applying heat until resistance remains constant for at least 4 hr.



TYPICAL LOG taken during dry-out period. Keep the heat on until insulation resistance holds steady for at least 4 hr

(primary and secondary) and electrical and magnetic paths (2) keeping the cooling system effective to insure free flow of heat.

Working Tips. Cleanliness is as essential to good service in a transformer as in a motor. This means tank outsides that are clean, and gaskets in good condition to keep out dust, dirt and moisture. Coils and terminal boards inside tank must also be kept clean. Sludge and sediment from old type liquid-filled units must be removed before they interfere with circulation, cut cooling.

When working about an open transformer, take care that tools don't fall into the windings. Anything dropped and allowed to remain can cause a breakdown. One solution is to tie all tools to the inspector's belt.

If it's necessary to take temperature readings within tank, use alcohol rather than mercury thermometers. Mercury is a good conductor and might cause trouble if thermometer breaks.

Simplest and most practical plant test of transformer insulation is measurement of insulation resistance with a megohmmeter. Any downward dip from past tests is a tip that trouble may be brewing. Some pointers on making such tests are given above.

Trends

Modern transformer design is headed toward greater safety, dependability, and better appearance with packaged equipment close to load area. Swing is also toward higher ratings and voltages. In larger units, tap changing under load has found its place in the power field.

Standardized equipment rather than "specials" for every job is resulting in lower first cost, faster deliveries. Impulse testing by manufacturer as "proof-test" of design has contributed much to transformer reliability.

Grain-oriented steels used in cores have raised flux densities. While use of oil inhibitors, especially in older free-breathing units, is currently on tap, it's often difficult, as yet, to justify added cost of inhibitors. But present experience shows any of four oil-preservation methods shown on p 79 maintain oil in good serviceable condition for many years.

Unit substations can be put on wheels. This allows fast, flexible replacement, cuts need for spare transformers.

Now let's take a quick look at what's happening to transformer size, insulation and cooling methods.

SIZE

Improved steels have made their big contribution in reducing transformer physical size for any given rating. At present it appears that any future squeezing of overall dimensions will come from improved insulations or possibly from conducting alloys rather than steels. But the pendulum will swing in the other direction if copper shortages force us to adopt aluminum. Reduced conductivity will raise conductor and over-all unit size.

Using one 3-phase unit instead of three single-phase ones in the larger units means overall size reduction per kva handled. And, considering the quality of today's transformers, there appears little need in the majority of installations to lean on the open-delta crutch with its additional first cost. That day is gone for good.

INSULATION

Insulation presents an ever-changing picture. As more is learned about true limits of each insulation, amount of insulation is usually reduced. More dependence is put on lightning arrestors to handle overvoltages. Sealed tanks and liquid-preservation equipment have done much to extend insulation life of transformer liquids.

Future insulation gains will probably be made in synthetic rather than natural material. Typical is development of Class H. This class came in with the silicones, introduced in large quantities some seven years ago, and grows with recent acceptance of the fluorocarbons.

Newest application of Class H to ventilated dry-type transformers permits operation in humid atmospheres without use of space heaters during shutdown.

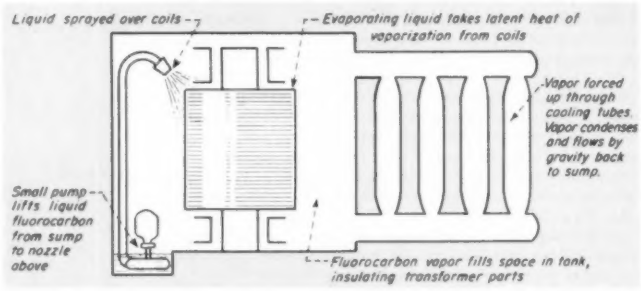
COOLING METHODS

Auxiliary fan cooling has done much to boost ratings while keeping over-all size within practical limits. Many transformers are bought today with basic provision for supplementary cooling should load growth warrant.

Although still in development stage, vapor-cooled vapor-insulated designs (*right*) are expected to be ¼ to ⅓ lighter than liquid-immersed units of equal rating. This new scheme uses vaporization of liquid fluorocarbons for cooling and vapor's dielectric strength for insulation.

Idea of using fluorocarbons – a new family of synthetic compounds – reveals promise. A vapor-cooled transformer will be as safe or safer than askarel or dry-type units since fluorocarbon liquid is not only non-flammable but has fire-extinguishing properties to boot. Vaporization removes heat better. It thus becomes possible to design a more compact coil assembly, reducing external cooling surface. There is no inherent limitation on size of vaporization-cooled units.

Vapor-cooled uses appear to be: (1) where super safety is needed (2) where space and voltage requirements rule out dry-type units (3) extremely compact installations using forced external cooling or a remote cooler.


Liquid sprayed over coils
Evaporating liquid takes latent heat of vaporization from coils
Vapor forced up through cooling tubes. Vapor condenses and flows by gravity back to sump.
Small pump lifts liquid fluorocarbon from sump to nozzle above
Fluorocarbon vapor fills space in tank, insulating transformer parts

VAPOR COOLING removes heat by vaporizing liquid. Dielectric strength of vapor serves as insulation. Liquid is non-flammable, has fire-extinguishing properties

ACKNOWLEDGMENTS

Liberal use was made of technical data supplied by transformer manufacturers during the preparation of this handbook. POWER is especially indebted to the following concerns for their fine cooperation: Acme Electric Corp, Allis-Chalmers Mfg Co, Associated Research Inc, Brown, Boveri & Co, Cole Instrument Works, Crittenden Transformer Co, Eisler Engrg Co, Electro Engineering Works, Erie Electric Co, Inc, The Esterline-Angus Co, General Electric Co, Jefferson Electric Co, Line Material Co, Marcus Transformer Co, Inc, Moloney Electric Co, Pennsylvania Transformer Co, Sorgel Electric Co, The Standard Transformer Co, Stockwell Transformer Co, The Superior Electric Co, Wagner Electric Corp, Westinghouse Electric Corp.

1 **CENTRALIZED CONTROL ROOMS** depend on reliability and accuracy of modern instruments and automatic-control systems. Designers are continually striving to simplify the equipment in rooms like these to lower investment and maintenance

Where Do Central Station Control And Instrumentation Stand Today?

Rising costs, size, pressures and temperatures have made adequate control systems a must in every power plant today. Highlights of boiler instrumentation symposium given before Philadelphia section of the Instrument Society of America

► FIVE SPEAKERS outlined present practices, problems and future possibilities in instrumenting central stations:

T Y Mullen, Gilbert Associates, Inc: An important instrumentation problem has been the appearance of radial cracks in high-temperature steam lines at the connections for flowmeter piping. It appears that, on large load swings, condensate from the constant-head reservoirs reenters the steam line, cascading over the superheated interior surface.

Fig. 3 shows nipples developed to reevaporate condensate flowing back into the header. Heat transfer through the main pipe wall and nipple wall prevents destructive thermal shock from acting on the main steam lead. This type of bend has been used recently in several high-temperature plants.

Premium prices for h-p h-t piping has led to using narrow diameters with consequent high steam velocities. This requires high-differential meters involving effects of fluid compressibility. Vapor density changes between inlet and outlet of the primary element. This may run about 2% and must be accounted for in calibrating a meter. This change is higher for flow nozzles than for concentric orifices with the same metering differential. The former is usually preferred for all welded piping.

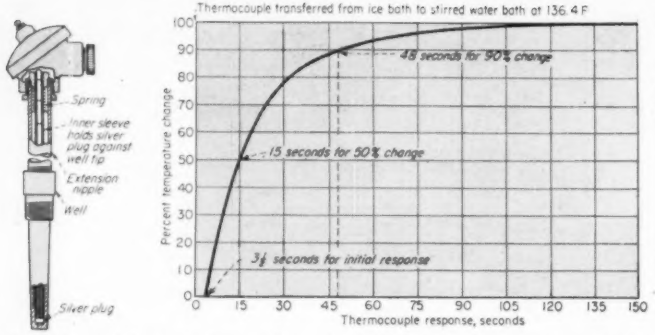
Reheat units usually bleed some steam for feedwater heating between the stop valve and return to reheater. This means separate metering of steam from superheater and from reheater to calculate boiler output. Reheater inlet and outlet pressures vary with load on the turbine. Pressure compensation must be used on reheater steam flowmeters, and fluid compressibility must be taken into account.

Reheat units generally don't reach rated steam temperatures till relatively high loads. This raises an additional need of temperature compensation for flowmeters for these units.

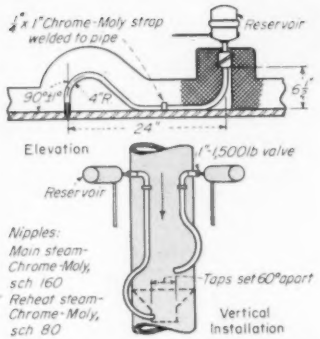
Feedwater temperatures of modern units vary from about 325 F at ¼ load to 450 F at full. This means a change of about 10% in fluid density, which must be accounted for in feedwater flowmeters as temperature compensation.

Turbine instruments that find increasing acceptance include speed and camshaft position recorders. These are important during startup and shutdown procedures and give important data on unusual governor performance during turbine emergencies.

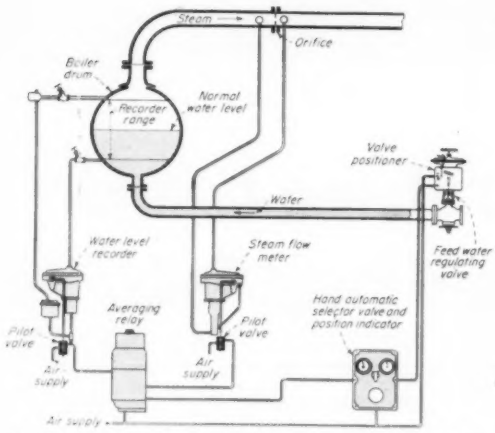
Eccentricity recorders give indica-


Thermocouple transferred from ice bath to stirred water bath at 136.4 F
Spring
Inner sleeve holds silver plug against well tip
Extension nipple
Well
Silver plug
Percent temperature change
Thermocouple response, seconds
48 seconds for 90% change
15 seconds for 50% change
3½ seconds for initial response

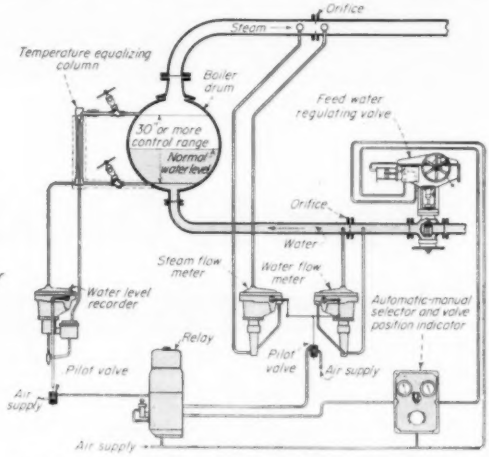
2 High-speed thermocouples must be used to achieve steam-temperature control that is adequate. Metal-to-metal contact will improve the response rate of this unit



3 Reevaporating nipples prevent the condensate reentering the steam line



6 Two-element pilot-operated feedwater control responds to change in the steam flow, level makes the final adjustment



7 Three-element pilot-operated feedwater control keeps the water and steam flow balanced, adjusts the water level

tions of shaft straightness during start-ups. Vibration recorders monitor critical points along the turbine-generator shaft giving continuous indications on balance. Differential expansion recorders show the rate of expansion of turbine shafts relative to the casings. They are important guides during quick starts and startup periods after emergency tripouts.

Central-control rooms pose the problem of receiving and tabulating a large amount of data while trying to retain a reasonable area of operation. One step toward solution is the multi-record instruments conserving panel-board and control-room space. These include temperature, pressure and combination recorders, and combination flowmeter and level recorders.

A second approach is the miniature instruments and small-diameter indicators in place of recorders. These include voltmeters, ammeters, wattmeters, clocks, draft gages, pressure gages, level gages and flow indicators.

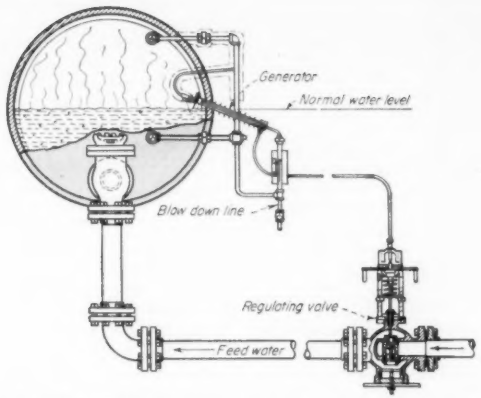
A third step to reduce panel-board-area needs has been the semi-central control room idea. This scheme uses indicating instruments for the operator with recorders on the rear of the panels and with subpanels for hydrogen control, soot blowing, pump control at various spots in the plant to reduce duties of the central-control-room operators.

Each solution has its advantages and disadvantages. Instruments and controls are being given more thought today than ever before.

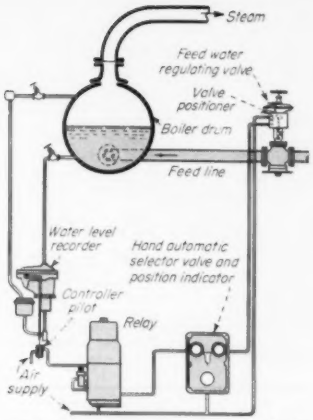
H C Mittendorf, Combustion Engineering-Superheater, Inc: In designing boilers it's important to keep in mind the method of connecting instruments to the unit. For instance, furnace pressure inserts are the joint responsibility of boiler and instrument manufacturers. Their location becomes important for a tall furnace. We have a standard that recommends installing the inserts about 3 ft below the furnace roof and 2 ft forward of the furnace exit tubes.

Furnace inserts in watercooled furnaces usually require bending the tubes. Separate inserts serve the gage and controller. A separate test insert is often specified. Unless these are aligned vertically and are close together, as many as six tube bends, sometimes in two planes, are needed.

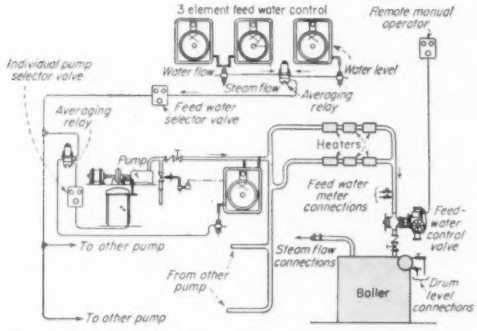
We feel that only one insert should be installed, then regular cleaning would be imperative. Facilities for connecting test manometers should be possible by valving-off and using short nipples in the operating instrument tubing. We also favor using one tap



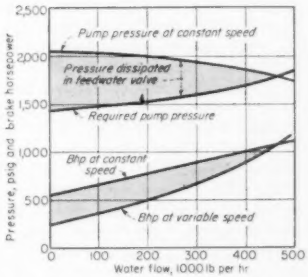
4 Single-element self-operated feedwater regulator allows level to vary, works best on fairly constant steam loads



5 Feedwater control, which is single-element, pilot-operated, holds level



8 Three-element feedwater control system adjusts the pump coupling speed ratio instead of the feed valve opening



9 Pumps with constant speed need more power input at the partial loadings

for air-flow measurement, air-flow control and superheat air-flow anticipation.

Division of gas flow by dampers, bypass lanes and reduced boiler convection surface has made it difficult to find satisfactory tap locations for gas-flow measurement. Instead, measurements are often made on the air side. This is satisfactory for oil- and gas-fired boilers even though some arbitrary restriction may be needed to create the required differential pressure. In pulverized-coal firing it does not measure the mill-tempering air which can introduce a sizable air-flow error.

Temperature measurement of water by thermocouples or resistance thermometers in wells has been quite satisfactory. Steam temperature measurement has been less so. Lag is the principal difficulty. Lag lies largely in the well, delaying measurement a full minute. The well lag, together with resistance, capacity and transportation lags, makes steam temperature control difficult. Anticipating means to overcome the system lag needs improvement quickly.

Separate wells in water lines and steam lines for operation and test measurements should be unnecessary. Transfer switches should be used to enable making test measurements from one well. Wells in h-p h-t lines are a costly item.

Stoker engineers and controller manufacturers disagree on the connection for controller elements. In general, we favor connecting the furnace-draft controller to the uptake-draft regulator rather than to the forced-draft equipment. Opening inspection doors causes a high inrush of air reducing air flow through the fuel bed if the f-d fan is connected to the furnace. For this reason it is not recommended.

E D Scutt, Leeds & Northrup Co: Automatic superheat and reheat temperature and combustion control involve adjusting many dampers, valves, feeders, etc. Sometimes a single controller supervises ten or more actuators in a combustion-control system. Some superheat and temperature control systems for a single boiler use as many as eight controllers. Often a single controller regulates dampers or tilting burners for one part of the load range and valves for remainder of the range.

Combustion Control. Steam pressure normally controls fuel input while boiler air flow may be regulated by either the fuel-air ratio or the steam-flow:air-flow ratio. When fuel flow can be metered accurately as in gas-fired boilers, the fuel-air ratio control is preferred. Me-

RECOMMENDATIONS FOR APPLYING BOILER FEEDWATER REGULATOR

Boiler capacity 1000 lb/hr	*Self-operated single-element*	*Relay-operated single- or 2-element*	*Relay-operated 3-element*
Below 75	For steady loads, building heating, continuous process	For irregular loads, batch processes, hoists, rolling mills	
75 to 200	Use only in special cases	For all steady and fluctuating loads	For extreme load and water conditions, boilers with steaming economizers
Above 200		Use only on steady loads	For all types of loads

Excess pressure ahead of feedwater regulators should be at least 50 psi.

Excess pressure should be controlled by feed-pump regulation. Use excess pressure valves only when excess pressure varies more than plus or minus 30%.

Where drum level is unsteady due to high solids concentration or boiler feed or other causes, use next-higher-class feed regulator.

tered gas and air flows balance against the common master loading impulse. Fuel and air change simultaneously in correct amounts to satisfy steady or changing loads. Some controls change air flow from steam pressure using fuel-air ratio controller to regulate gas flow. This doesn't let gas-flow change lead air-flow during load drops.

The steam-flow:air-flow ratio control proves the most practical for pulverized-coal-fired boilers despite limitations of the method in flow measurements and varying temperatures.

Originally steam-flow:air-flow acted as recorrection rather than as isolated primary control. This adjusted air flow and fuel feed with each change in master loading, regardless of whether the master was correcting for change in steam demand or change in fuel feeding conditions. Since coal feeding conditions change more frequently than load in normal plants, it has been more practical to regulate air flow directly from steam flow and independently of steam pressure. This minimizes boiler air-flow changes that affect superheat and reheat temperatures. Upsets from wet-coal feeding interruptions and changes in coal heating content are minimized.

Increased physical size of boilers with larger capacities has introduced longer control runs. The controls must accommodate the longer runs without causing any lag in control response. One system replaces a pneumatic loading pressure with an electronically balanced wheatstone bridge system to avoid lag, but the actuators are pneumatic or hydraulic cylinders.

Electric actuators have gained favor for outdoor installations because they are easily weatherproofed.

Decreasing heat-storage capacity of modern large boilers demands immediate proportioning of combustion rate to loads to avoid serious operating upsets. With progressive system interconnections, operators have found it better to have each unit share in load swings within its area. It seems that multi-element master controllers would be needed to meet this trend in plant design and operation. Steam flow has at times been used as a second element of the master steam-pressure controller. Steam flow and pressure change together, but steam flow gives a qualitative measure of the load change after it occurs.

Generator load has also been used as second element in master controller action. This also gives a quantitative measure of load change. Neither steam flow nor generator load, however, can be considered as anticipating elements.

Actual load change on a boiler unit can be anticipated by regulation being applied to the speed-changer motor on the turbine governor. This actually changes the combustion rate on the boiler during an electrical load change in advance of actual steam demand.

Steam temperature controls on some installations practically equal combustion-control investment. Problems handled by temperature controls are often tougher than those of combustion control. These stem from the time lags involved and the many variables within a boiler that can change steam temperature. A change of 10 F at 950 F corresponds roughly to 6 Btu per lb steam. This is about ½% of the total heat being absorbed by the water being converted to steam. While the combustion control regulates total Btu input to the boiler, some of which may be stored, the temperature control regulates the input-per-lb steam within close tolerances.

Table below shows average time lags for a number of plants. Considering these lags, together with the aim of trying to control temperatures within 10 F, shows how difficult the control problem can be.

Control element	Average Response, Min: First response	Full response
Spray valve	0.9	4.5
Shunt damper	2.1	8.0
Tilting burners	1.5	5.7
Bypass damper	1.5	8.7
Condenser valve	3.4	8.0

Fig. 2 shows a high-speed thermocouple and well, developed for superheat and reheat temperature control. Silver plug below gives metal-to-metal contact between thermocouple and well. This reduces detection time to a minimum since the metal mass is small and conduction is through metal. Graph shows the response curve when the assembly was transferred from an ice bath to a 136-F water bath.

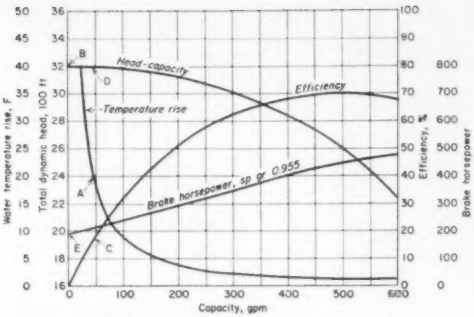
Boiler air flow is the simplest and most common element used for anticipating action in steam-temperature control. Except for boilers with large radiant superheaters, steam temperatures normally increase with higher combustion rates. With correct combustion, boiler air flow directly indicates the combustion rate and should assist control in the proper direction. Air flow can also be measured with a minimum of time delay.

Other elements have been considered, such as steam flow, spray or condenser-water flow, flue-gas temperature, recirculated-hot-gas flow, spray-outlet temperature. Some of these flows are limited for control use since they reduce to zero and can't be measured accurately over the entire range. It has also been hard to get an average measurement of flue-gas temperatures at the superheater and reheater surfaces that bears a definite relation to steam temperature.

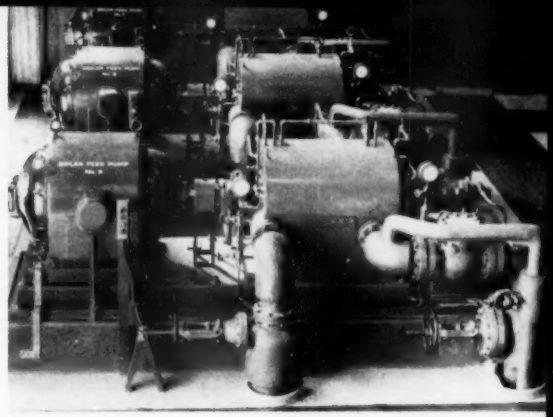
Most reheat installations today have at least two means of controlling one of the temperatures. This requires sequence control of two actuators from one controller. Lag characteristics may be entirely different for the two methods of control. Adjustments must be in the equipment as controller transfers from one actuator to the other.

On some recent reheat designs, regulation of each of the temperatures affects the other temperature. For example, amount of hot gas recirculated affects both reheat and superheat tem-

(*Continued on page* 208)



CHARACTERISTIC CURVES for a centrifugal pump. Head, brake horsepower, efficiency and temperature rise are all plotted



BOILER FEED PUMPS often run throttled when the water flow is regulated. Don't run under the minimum safe flow at any time

Don't Overheat Centrifugal Pumps

By **ED CONDICT**
Application Engineer
De Laval Steam Turbine Co

► EVERY CENTRIFUGAL PUMP has a minimum safe flow. If pump runs continuously at a capacity less than this, temperature of liquid pumped rises until flashing occurs. Unit becomes vapor-bound and stops pumping.

Pump Power. The brake horsepower (bhp) needed to drive a pump is that supplied to coupling by driver. Water horsepower (whp) developed is useful work pump does. Efficiency of pump is whp/bhp.

Bhp includes all losses, mechanical and hydraulic. Mechanical losses are bearing, packing and disk friction. Hydraulic losses are in impeller and volute passages, plus leakage. Leakage losses are at wearing rings, interstage or leak-off bushings, and balancing devices, when used. Heat generated by hydraulic and disk friction causes fluid temperature to rise during passage through pump.

Bearing and packing losses are 1 to 2% of total; neglect them when figuring fluid temperature rise. Rise is caused by difference between bhp and whp and is called heat horsepower.

Temperature-Rise Formula. Curve shows characteristics of a centrifugal pump. Head, efficiency, bhp and temperature rise are plotted against capacity in gpm. Temperature-rise curve is calculated from this formula:

$$t = \frac{(1-E)H}{778E} \qquad (1)$$

where t = temperature rise, F; E = efficiency, expressed as a decimal; H = total dynamic head, ft.

Minimum safe flow through pump depends on suction conditions, especially in boiler-feed service. There, net positive suction head (npsh) determines minimum safe flow because it fixes temperature rise of water before it flashes to steam. This is called allowable temperature rise.

Minimum Safe Flow. Assume pump in curve handles 220-F water and npsh is 18.8 ft, the pressure, above vapor pressure at impeller eye. At 220 F, vapor pressure is 17.19 psia and liquid specific gravity is 0.955.

Npsh of 18.8 ft = 18.8 × 0.433 × 0.955 = 7.78 psia at 220 F. Vapor pressure to which water may rise before it flashes is 17.19 + 7.78 = 24.97 psia. This pressure corresponds to 240 F. Allowable temperature rise of water is 240 − 220 = 20 F. Rise of 20 F on temperature curve corresponds to 47 gpm, point *A*. This is minimum safe flow for this pump in handling 220-F water with 18.8-ft npsh.

Trial and Error. Plotting temperature rise of a pump and then finding capacity at which this equals allowable rise is an accurate method of calculating minimum safe flow. About what this value will be is often found by trial and error.

Temperature rise for a selected minimum capacity is found by trial. If this is about the same as allowable rise, minimum safe flow is chosen accordingly. If there is too much difference between trial and calculated temperature rise, use other trial capacities until a satisfactory one is found. With practice, a minimum safe flow is easily found.

Other Methods. A value of safe minimum flow, accurate enough for all practical purposes without using trial and error, is found from this formula:

$$N = \frac{100SOP}{778t + SOP} \qquad (2)$$

where N = percent pump efficiency at safe minimum flow; SOP = shutoff head of pump, ft; t = allowable temperature rise, F.

Assume the pump in curve handles 220-F water, npsh is 18.8 ft. As figured before, allowable temperature rise is 20 F. Shutoff head, SOP, is 3200 ft, point *B*. Then efficiency for minimum safe flow is from formula (2)

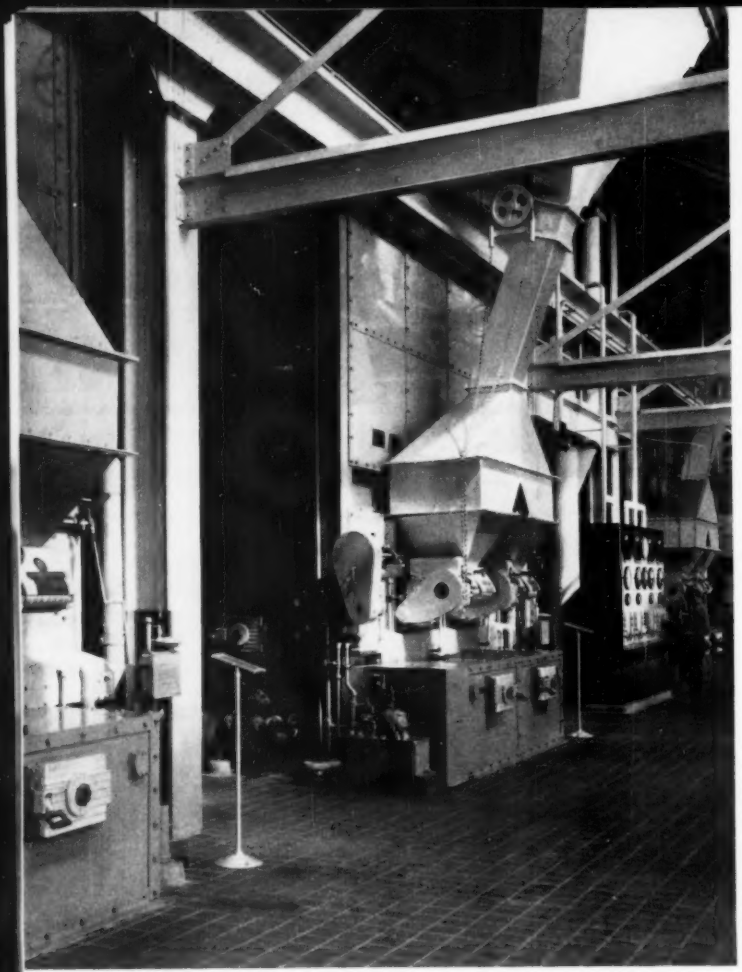
$$N = \frac{100 \times 3200}{(778 \times 20) + 3200} = 17\%$$

At this efficiency, capacity is about 47 gpm, point *C*. This is the same as obtained by the accurate method of plotting temperature-rise curve.

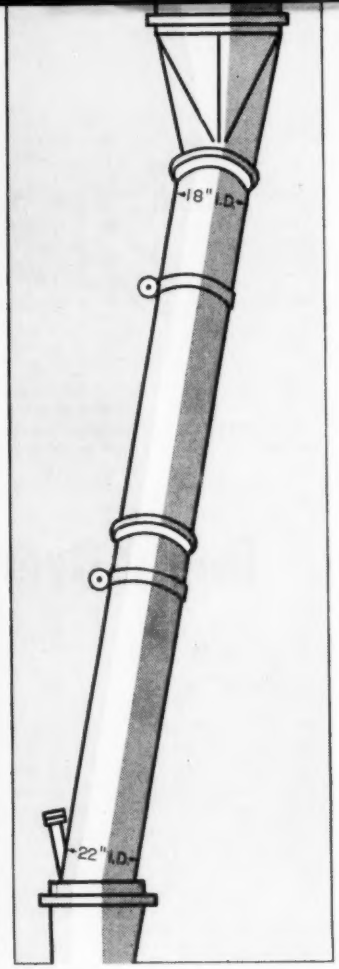
Total head at 47 gpm is 3195 ft, point *D*. Temperature rise for these conditions is:

$$t = \frac{(1-0.17) \times 3195}{778 \times 0.17} = 19.99 \text{ F}$$

This shows rise will be slightly less than allowable because head at minimum safe flow is less than shutoff. Thus, error is on the safe side. A satisfactory answer is obtained the first time by formula (2).



1 Coal feed from storage to the boiler hopper is a vital part of good power-plant operation. Proper materials coupled with correct layout give the best results



2 Flaring chutes in direction of flow reduce tendency toward compacting

Good Design Solves Coal-Handling

Corrosion teams up with compacting to form major enemy of coal handling. Here is how you can set up a handling system that will stop corrosion cold, reduce compacting effect

By **MANOLO WEICHERS**
Development Engineer, Lukens Steel Co

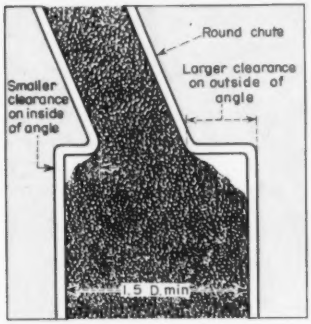
► KEEPING COAL MOVING from bunkers through hoppers and chutes to pulverizing mills and stokers can be uninterrupted, with almost no repairs or replacements. This means no more air lances, sledge hammers and vibrators! But to bring about such an operating miracle there has to be a well-thought-out design and judicious use of the best available materials. Here is the basic reasoning behind it.

Design. All coal coming into your plant contains moisture. When you keep it in a storage pile and let it weather, this moisture content increases. Further, the greater the amount of fines, resulting from bulldozers and carryalls working over the pile during storage, the greater the coal's capacity to retain moisture.

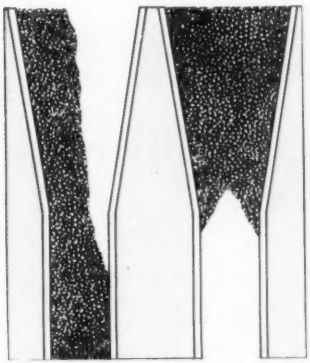
This moisture proves the dominant factor in stoppages and the chief threat to equipment life. Its presence leads to two effects: physical (compacting), and chemical (corrosion). Together they accelerate the causes of stoppage.

As moisture content in coal moving

PATTERNS FORMED IN CHUTES BY MOVING COAL STREAMS



3 Break-away put in at change of coal direction lets coal realign itself



4 Compacted coal forms rat-holes, *left*, or arches, at *right*, unless corrected

Headaches

through bunkers, hoppers and chutes climbs to the critical range (5-6%), the static angle of repose increases sharply and along with it comes a greater tendency toward compacting. Ratholing, arching, Fig. 4, and complete stoppage result.

Design will lick this tendency toward compacting. Steps like these prove helpful:

1. Make all bunkers and hoppers of cone design with the least possible taper.

2. Give chutes a constant increase in cross section (flare) in the direction of flow, Fig. 2.

3. Use round or oval shapes in preference to square or rectangular.

4. Where two streams of coal meet, keep the angle of convergence at a minimum.

5. Avoid any constrictions or otherwise cramped conditions.

6. Change directions of flow as gradually as possible. Try to fit in the "break-away" design which helps coal realign itself when sudden direction changes are necessary, Fig. 3.

7. Let nothing project into the flow system. Where you have flange connections to join sections of chutes, grind the inside welds so no ledge effect exists.

8. Give the entire flow system the maximum angle of inclination to the horizontal.

9. Put in corrosion-resistant and abrasion-resistant materials where possible. Remember, the inside surfaces should have as low a coefficient of friction as you can get. For this reason they should stay smooth and not be roughened by the products of corrosion and erosion.

All these steps have as their basis the fundamental aim of good design—establishing a flow pattern as streamlined as possible. Specific steps, above, provide the mechanical aids you need to keep coal moving smoothly in the usual power plant. Special problems call for special solutions.

Corrosion, Erosion Control. So much for the physical or compacting troubles and their control. How about the chemical problems that moisture and coal treating-agents present?

Bituminous and semi-bituminous coals contain varying amounts of iron sulfides (pyrites and marcasite) depending on the coal's origin. In the presence of water and oxygen these sulfides produce dilute sulfurous and sulfuric acids that can readily attack the steel members of a coal handling system. The attack is not uniform over the entire area but rather spotty. Coal flow continually rubs off the corrosion products, exposing clean surfaces to further attack. The combination of corrosion and erosion accelerates metal wear. The net effect shows as uneven wear and a marked roughening of the inside steel surface. This roughening increases the coefficient of friction and aids materially in initiating a hang-up.

Calcium chloride or other chemicals added to coal to prevent freeze-up in transit or storage often appear as leachings. These leachings embody corrosives that can cause the difficulties we just described.

No matter what the cause either attack carried through to conclusion completely eats through the steel in spots requiring temporary "half-soling" and, finally, replacement. Under these conditions carbon-steel chutes and hoppers average about two to three years' life with a heavy maintenance toll right along to correct ratholing and arching, Fig. 4.

Material Selection. In addition to the flow-design considerations above, for reducing the compacting tendency of a moving coal there are definite improvements you can make with better material selection. Let's look at what's available.

Resilient materials for linings offer a low coefficient of friction in general but certain of them are highly subject to abrasion. Further they are difficult to apply to the shapes used in coal handling and, lastly, their costs run high.

Concrete bunkers, in addition to their great weight, suffer from a high coefficient of friction, a weakness to acid attack and no self-cleaning features.

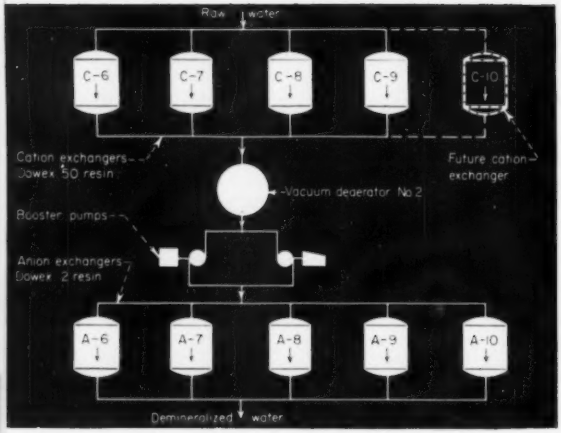
Clad steel has come to the fore as an ideal material. It consists of a carbon or low-alloy-steel backing plate with one or both surfaces covered with a uniform, inseparable, bonded corrosion-resistant metal (10-20% of total plate thickness). The backing plate provides the required strength and stiffness, and the cladding the desired surface characteristics.

Certain special stainless-clad steels and monel-clad steels give excellent results. (Monel's high cost, though, works against it.) These materials give a very low coefficient of friction. With stainless-clad metals, initially descaled with sodium hydride, coal flow over these surfaces produces a high polish that further reduces the friction coefficient.

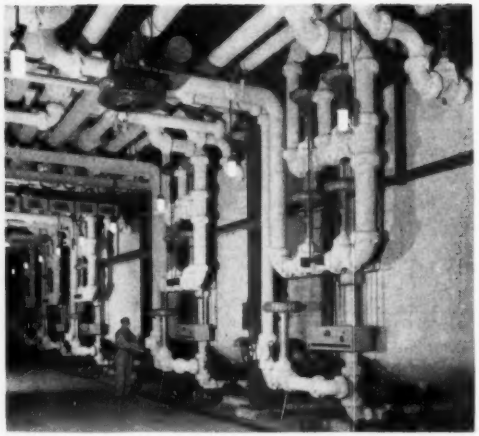
Acid produced in the coal by the action of water and oxygen seems to have no noticeable effect, based on actual experience records in several utility plants. In one such case a stainless-clad steel coal chute has been in service five years with no evidence of corrosion or loss of gage. This long service life (over twice that of carbon-steel chutes) seems the strongest advantage.

What's more, there are operating advantages. A second company, using monel-clad steel in the bottom six feet of each of four bunker noses, reports no feed failure from stoppage. Costly maintenance is a thing of the past.

But for any individual power plant there has to be a special study before deciding which factors dominate, what material will prove best, how far-reaching changes should be in design or material selection. A good team for such a study would include competent engineers, the equipment user, manufacturer and material suppliers. From such a team would come the best solution for the least maintenance and the most economical equipment.



1 Section 2 demineralization plant, designed for 1500 gpm, on occasion has supplied up to 2000 with first-rate result



2 Operating aisle of new Section 2 demineralization plant affords ample room for any needed repairs or observations

Demineralization Builds Up An Excellent Operating Record

You need water treatment at its best to get feedwater pure enough to (1) lick high makeup and silica problems in high-pressure boilers (2) avoid solids buildup in high-heat transfer tubes of cyclone furnaces. Demineralization does the job

By M E BRINES[3]
Assistant Superintendent of Power
Dow Chemical Co, Midland, Mich.

►At its Midland, Mich. plant Dow Chemical Co made the first industrial application of the cyclone-fired-furnace[1] as well as the pressure-furnace design, using no induced-draft fans at all. Such pioneering imposes heavy responsibilities on the entire boiler cycle, including feedwater treatment. For this phase of boiler operation demineralization was selected as the answer.[2]

Cyclone furnace represents the most critical area for feedwater problems. Here surface deposition tends to run heaviest. Heat-transfer rates reach as high as 288,000 Btu per sq ft per hr according to thermocouple readings. The reflecting arch also experiences extremely high heat-transfer rates.

Watertubes in this area give the cyclones a natural circulation through this cycle. A 21-in. downcomer from the steam drum feeds the bottom one of two headers supplying the cyclones. Semicircular, 1½-in.-OD studded tubes, rolled into these headers, surround each of the cyclone furnaces, which are 8 ft dia, 11 ft long. Water from the bottom header moves up through these semicircular tubes to the top header. From there it enters tubes that form a portion of the secondary furnace's front wall and discharge into the steam drum.

A layer of molten slag covers the plastic chrome ore protecting these studded semicircular cyclone-furnace tubes. Heat release gets as high as 545,000 Btu per cu ft per hr in the cyclones compared to 32,300 Btu per cu ft in the entire unit. So fast-moving, clean water is imperative.

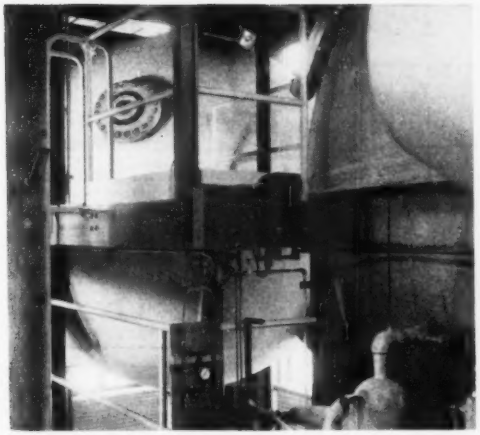
Available Water. When these cyclone units were planned, special provisions went in for proper water supply.[2] It was a 1500-gpm demineralization system, called Section 1, comprising sulfonated-phenol-formaldehyde cation exchangers, and aminated-phenol-formaldehyde anion exchangers followed by a cold-water vacuum deaerator for CO_2 and dissolved-oxygen removal. Sodium fluoride was added to remove silica.

When two additional 400,000-lb-per-hr cyclone boilers came on the line a second 1500-gpm demineralization plant known as Section 2 was ready, Fig. 1.

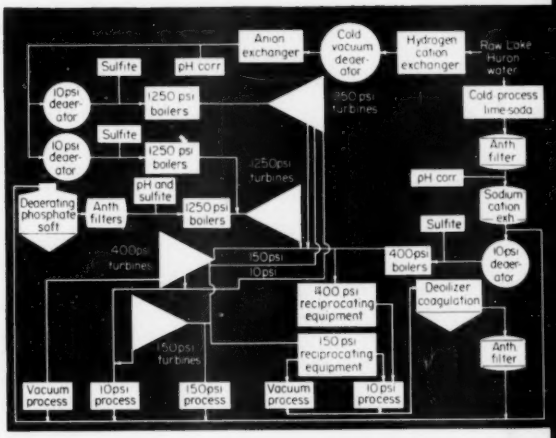
[1] "Pioneer Industrial Cyclone Furnaces for Dow Chemical's 1250-Psig Boiler," Power, p 72, March 1949. Also, "Dow's New 100% Cyclone-Fired Plant Improves as Pioneer Installation," p 74, Power, Aug 1950.

[2] "Demineralization Supplies 100% Makeup for 1250-Psi Steam Generator," Power, 96, Nov. '49.

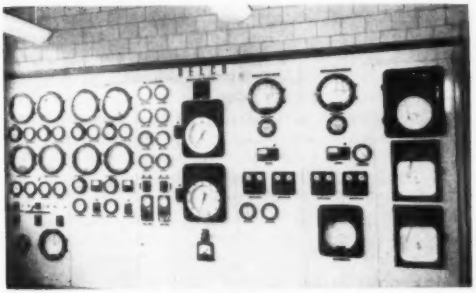
[3] Developed from the paper, *Demineralization Plant Operating Experiences*, American Power Conference, Chicago, Ill., March 27, 1952.



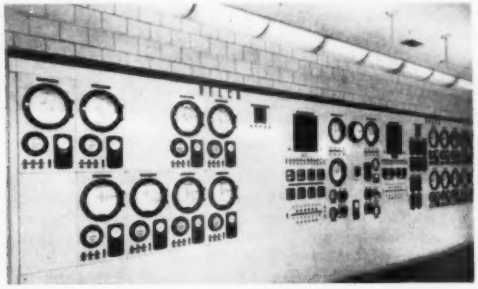
3 Vacuum deaerator, with entering-spray valve clean, meets guarantees of 2 ppm CO_2 and 0.2 ppm dissolved oxygen



4 Flow diagram of steam and feedwater cycles show how new treatment equipment ties into the overall plant operation



5 Service panel records raw water to filters and into cation exchangers plus effluent from all units pictured in Fig 1



6 Operation and regeneration panel mounts valve diagrams, flowmeters and controls for both cation and anion units

It uses greatly improved ion-exchange resins available at time (May '50).

For the four cation exchangers we picked 520 cu ft each of Dowex 50 (Nalcite HCR), a sulfonated polystyrene resin of high capacity, and for the five anion exchangers, 639 cu ft each of Dowex 2 (Nalcite SAR), a highly basic polystyrene resin. This resin contains quaternary amine groups that remove silica directly thus saving two steps we went through in Section 1: (1) sodium fluoride feed step to the cation exchangers, (2) acid salt addition in the regeneration of the anion exchangers.

Since Dowex 2 (Nalcite SAR) removes CO_2 we put the vacuum deaerator, Fig. 3, between cation and anion exchange units to free most of the CO_2 mechanically and thus relieve the ion exchange capacity for other service.

Results have been excellent. Although design calls for 1500-gpm duty the system works very satisfactorily at 2000 gpm and on occasions up to 2200. We've been able to supply three 400,000-lb-per-hr boilers instead of the two planned for. What's more, Section 1 has not been put in service since the new Section 2 became available.

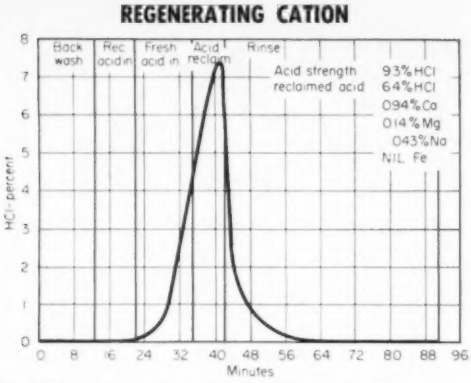
Prefiltration. The old Section 1 matched the anticipated ion-exchange capacity by establishing an operating record of 800,000 gal per cycle on each of the phenol-formaldehyde cation exchangers. Section 2, though, developed sodium break-through at about a million gallons against an expected 2¼-million-gal cycle. An inspection before backwash of the bed surface at apparent exhaustion indicated channeling.

Raw-water supply to the cation exchangers averaged 3-ppm turbidity. But about five days a month turbidity exceeded 5 ppm and, on occasion, climbed as high as 23 ppm.

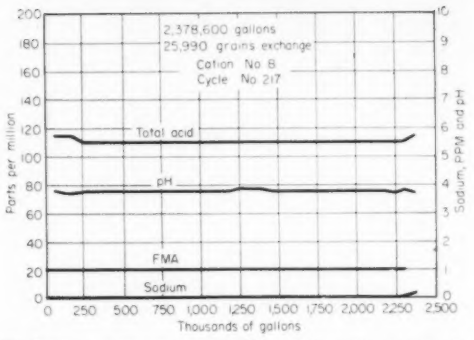
Since Section 2 produced all required demineralized water and Section 1 acted as standby, we converted Section 1's cation exchangers to prefilters and left the exhausted phenol - formaldehyde resin in the shells as filter material. All fouling and channeling in Section 2's cation exchangers stopped and the acid efficiency jumped from 22 to 62%.

Controls. One man operates the entire system from a central control room. Here we bring all flowing samples—raw, filtered, all individual exchanger effluents, deaerator effluents, demineralized water before and after pH adjustment—for laboratory-control tests.

The 20-ft service panel in Fig. 5 re-



7 Cation regeneration cycle proceeds step by step automatically to completion once it is started by the operator



8 Cation exchangers average 2½ million gallons per cycle, amounting to between 26,000-30,000 gr per cu ft of resin

cords raw-water flow to prefilters; cation exchangers; cation effluent to deaerators; anion effluent; demineralized water to each power plant. Demineralized-water conductivity and pH before and after pH adjustment appear on this panel as do the deaerator and booster pump gages and controls.

The 40-ft unit operation and regeneration panel, Fig. 6, contains individual exchanger flowmeters and controls, regenerant controls, level recorders, automatic backwash and rinse timers, plus regeneration flow diagrams with pilot lights to indicate valve positions.

Regeneration Cycles. With this unit operation and regeneration panel, the operator can make any number of cation regenerations without leaving the room. A mixing controller operates automatically when the strong-acid pumps are thrown on from the control room. This controller fills the fresh hydrochloric-acid regenerant tank with any desired-strength acid. A photoswitch stops the pumps at the proper level and separate records are made of the gpm of concentrated acid and water in each batch.

A cation-regeneration cycle has these steps: (1) 20 minutes backwash at 5 gpm per sq ft (2) recycled acid (from previous regeneration) at 312 gpm for 10 minutes, equivalent to a 3 gpm per sq ft rate (3) fresh acid (10% HCl in at 312 gpm for 13 minutes, or 4000 gal (4) acid reclaim at 400 gpm until 3120 gal are in the tank (5) rinse for about 45 min at 460 gpm until effluent is sodium free. Once started, this cycle goes through automatically to completion step by step. Tank-level controls interlock into the cycle so regeneration cannot start unless tanks are filled to the proper level. A low-level release permits the operator to start a cycle under abnormal conditions.

For anion regeneration the operator fills the caustic-soda regenerant tank with water to a predetermined level. Then he pumps enough 50% NaOH from storage to give 8800 gal of a 2.5% solution. Solution is heated up to 100 F for more effective silica removal. From this point regeneration becomes entirely automatic including the regenerant tank's interlock. It follows this cycle: (1) backwashes for 15 or 20 min —depending on the timer setting—at 500 gpm (2) introduces 100F caustic regenerant at 140 gpm (3) gives regenerant lateral rinse (4) rinses to waste for one hour at 150 gpm (5) continues rinse to waste at 350 gpm until conductobridge starts rinse reclaim pump; this control is set to correspond to raw-water conductivity (6) continues rinsing and pumping into the raw-water header until conductivity of rinse water shows less than 5 micromhos.

Exchanger Details. Cation exchangers, Fig. 2, measure 11½-ft dia and the anion ones over 12-ft 9-in. All have a straight side height of 11 ft with dished top and bottom heads and monel metal underdrains on each shell bottom. A 12-in. layer of graded anthracite supports the 5-ft-thick resin beds, leaving space for 100% free board for bed expansion during backwash. Saran-rubber linings cover all exchangers, deaerators, valves, fittings and piping in Section 2. Ground cork insulates the external surface of all tanks, piping and pumps to prevent condensation of atmospheric moisture.

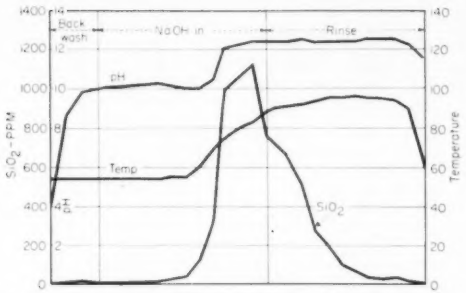
Deaeration. A 15-ft-dia sphere, Fig. 3, serves as the deaerator for Section 2. Cation effluent enters through sprays at the top, cascades over redwood packing. A 3-stage steam-ejection system at the equator pulls out vapors through special baffling. Tailwater from three barometric condensers flows over a weir for measurement before pumping back into the raw-water header. Noncondensables vent through the roof from the after-condenser. Level controls maintain about 30 in. of water in the deaerator. The Saran-rubber lining, despite the high vacuum (about 0.5 in. Hg), has prevented any corrosion troubles.

But corrosion can develop in the entering spray valve causing improper break-up of water with a resulting 5-ppm CO_2 concentration in the effluent. Yet there is no sacrifice in demineralized-water quality because the highly basic anion resins following the deaerator mop up the residual CO_2. With the atomizer under design conditions results come well within guarantees of 2 ppm of CO_2 and 0.2 ppm of dissolved oxygen.

Operating Results. The demineralized water quality has exceeded expectations based on laboratory or semi-plant scale. Specific conductivity consistently stays below one micromho and averages about 0.75. CO_2 does not show at all in finished water. Silica content keeps so low results are always questioned. As a practical matter we set 0.03 ppm as the cutoff and consider a cycle exhausted at that point. We have checked our analytical results by spectroscopic and infrared analysis and find the agreement is reasonable.

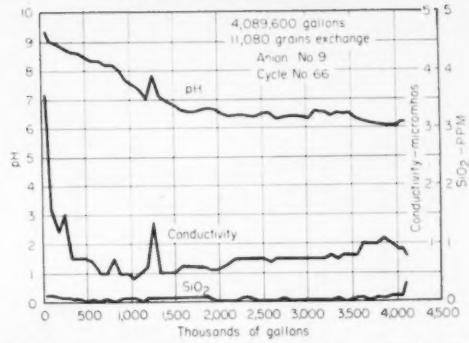
At times Lake Huron water shows an abnormally high turbidity, which carries along with it some insoluble colloidal silica. Although conventional

REGENERATING ANION



9 Conductivity and pH fluctuation at 1.2 million gallons, above, was caused by a new, incompletely rinsed cation unit

ANION CYCLE ANALYSIS



10 Backwash needs ran 14.1 gal per cu ft and rinse to waste equalled 43.9 gal per cut ft, less than 1% water loss

I: DEMINERALIZATION COSTS

	Month of Nov 1951	Cost in cents per 1000 gal demineralized
Raw water, gal	81,924,900	
Lost in process, gal	5,440,800	
Demineralized, gal	76,484,100	
Lost in process	6.67%	
Lb, 100% HCl	106,080	
Lb, 100% NaOH	38,000	
HCl @ $4.00 per cwt	$4243.00	5.5¢
NaOH @ $2.80 per cwt	1064.00	1.4¢
Regenerant	$5307.00	6.9¢
Raw water at 10¢ per M	8193.00	10.7¢
Regenerant and raw-water cost	$13,500.00	17.6¢

II: ANALYSIS OF WATER

RAW WATER		BOILER WATER	
pH	8.0	pH	10.5-10.7
Calcium as Ca	30	NaCl	25
Magnesium as Mg	8	Na_2SO_3	20
Sodium as Na	3	Na_2SO_4	30
Chloride as Cl	10	Na_3PO_4	20
Sulfate as SO_4	12	SiO_2	5
Bicarbonate as HCO_3	105	"P"	31
Hardness as $CaCO_3$	102	"M"	59
Silica as SiO_2	1.7	Conductivity	300
Iron as Fe	0.04		

DEMINERALIZED WATER		FEEDWATER	
pH	7.0	pH	9.0
Silica as SiO_2	0.02 max	Silica as SiO_2	0.02 max
Iron as Fe	0.01 max	Iron as Fe	0.02 max
CO_2	Nil	CO_2	Nil
Dissolved oxygen	0.15	Dissolved oxygen	Nil
Conductivity	0.75	Phosphate as PO_4	0.25
		Conductivity	3.00

colorimetric methods of analysis for silica in the finished water show none, all of the insoluble silica is not being removed. It enters the boilers and is digested in the alkaline boiler water at 1250 psi where it appears as abnormally high soluble silica. To control it we have to resort to over-blow of the boilers. Coagulation may solve the problem. Mixed bed demineralization, we feel, won't remove the insoluble colloidal silica.

For normal demineralization work, however, our anion exchangers average runs of 4,000,000 gal—equal to about 11,000 gr exchange per cu ft. Silica removal during regeneration of our No. 9 anion exchange, Fig. 10, following cycle 67 amounted to 56.8 lb, very close to the silica known to be in the raw water during this cycle.

The cation exchangers average 2¼ million gal per cycle to the sodium break-through point, somewhere between 26,000 and 30,000 gr exchange per cu ft.

Costs. Table I shows the demineralization costs of raw water and regenerant based on a typical month, Nov 1951, using market prices of acid and caustic with freight equalization. We did not include capital investment, overhead, labor because we could not make a direct comparison between different plants and localities. Expressed another way, Table I costs, for regenerant only, are 0.88c per kilograin of cations removed and 0.76c per kilograin anions removed.

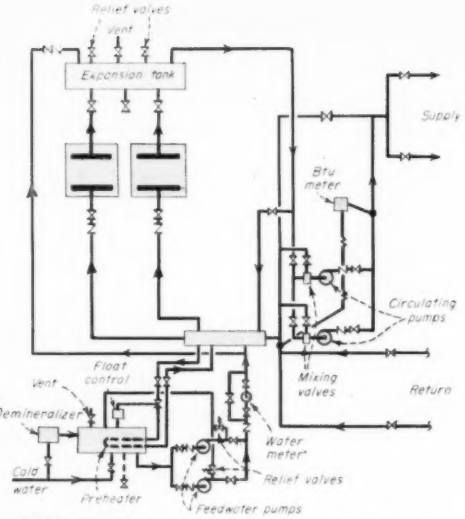
Piping and Storage. Demineralization plant stands about 1½ miles from the first cyclone-fired boiler. Demineralized water reaches it through a 14-in., cast-iron, bitumastic, enamel-lined pipe that dumps to a 470,000-gal storage tank. Two short sections of this pipe run are welded-steel construction, one on a railroad overpass and the second on a bridge over a small river. The storage tank's inside has a protective lining of two brush-applied coats of red lead, still in perfect shape after repeated inspections.

But this tank provides only enough feedwater for six hours' normal operation, and illustrates the difference between problems in a 100% makeup plant and a condensing central station plant. For example, outdoor cold-water storage presents a freezing problem in Michigan winters. So we planned the tank for continual water movement. The inlet line entered horizontally 10 ft from the top of the tank. Water left near the bottom. Freezing never occurred but another problem cropped up.

We picked the water tank's size to: (1) allow an orderly shutdown of the boiler in a prolonged demineralization plant outage (2) compensate for dif-

(*Continued on page 206*)

1 **OVERHEAD PIPES** convey h-p h-t water to and from an industrial plant. Supply and return may also run underground



2 **BOILER-ROOM** piping for typical h-p h-t plant. Arrangement shown gives good results without complication, high cost

Shave Your Heating Costs With H-P

► INDUSTRIAL AND COMMERCIAL plants need heat for space and process use. High-pressure high-temperature (h-p h-t) hot water is good for both.

Space heating may be half an industrial plant's load. In commercial buildings it is often the entire load. For certain forms of panel radiant heating and with some unit heaters, h-p h-t water is run directly through the coils. Piping is simpler and system cost less than for steam.

Year-round air-conditioning units also use h-p h-t water in their heating coils. Factory-type wall convectors and grilled tubes are other elements suitable for hot-water heating. Radiant-heating panels using h-p h-t water emit over 500 Btu per sq ft. They are especially good where dust in production and research areas must be avoided.

Process Heat. Close temperature control, central and individual, makes h-p h-t water ideal for many process jobs. Some industries making use of it today are textile, chemical, plastics, rubber, ceramics, paper and metal-finishing.

An outstanding advantage of h-p h-t water over steam is elimination of pressure drops from sudden loads. With a large quantity of hot water in a system there is an accumulator effect not obtainable with standard steam systems. By regulating hot-water flow or blending hot and cold water, quantity of heat emitted by coil or jacket is easily controlled.

Specific units where you can use h-p h-t water are dye vats, plating tanks, degreasing and washing baths, jacketed pans, evaporators, drying ovens, kilns and presses of various types.

Ice and Snow Removal. For airports, garages, bus depots, plant sidewalks and roads, h-p h-t water gives economical snow removal. Circuit is closed, automatically controlled by outdoor anticipating thermostats.

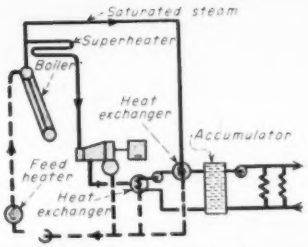
District Heating. Fixed charges per unit are reduced when power-plant equipment is fully loaded 24 hr per day. If heat is stored at off-peak periods, over-all efficiency of plant goes up. Plants that combine electric power generation with h-p h-t hot water district heating (thermal electric stations) have high efficiency because heated water is stored in an accumulator during off-peak periods. Boilers run at full load around the clock. Accumulators used this way in Hamburg and Berlin, Germany, and London, England, have been most successful.

Plants serving electric and heating loads should have an annual load factor equal to that of efficient condensing stations. Power demand should be independent of daily and seasonal heating load changes. If desired, accumulator can store cooling water in summer. Air-blast coolers will reduce water temperature when necessary. Overhead piping, Fig. 1, or underground pipes convey water to point of use.

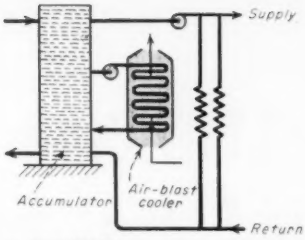
In some plants, efficiency increase permits reducing boiler capacity by increasing steam pressure. Fig. 2 shows a typical piping hookup for a h-p h-t boiler room.

Station Economics. Fig. 6 shows the effect of backpressure on plant heat rate and boiler capacity when both electric power and h-p h-t hot water are generated. A thermal electric station is compared with condensing stations running with 28 and 29 in. Hg vacuum.

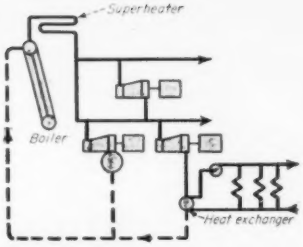
Backpressure of 40 psia, suitable for heating water to 260 F, increases boiler capacity 58 and 52%, respectively, at 28- and 29-in. vacuum. With 10-psia backpressure the power-generation factor (kwhr per million Btu) is 97 kwhr, compared to 74 kwhr at 40-psia backpressure. This shows cost of thermal electric station is not greater than a



3 **EXTRACTED** steam heats h-p h-t water which is then stored in accumulator



4 **IN SUMMER** water in accumulator can be used for condenser serving turbine



5 **CONDENSING** turbine takes steam in the periods when not needed for water

Last month we reviewed h-p h-t system design. Here are application details for your plant

By **OWEN S LIEBERG**, *President*
American Caliqua Co

H-T Hot-Water Systems

condensing station when backpressure is reduced sufficiently. Higher boiler cost is offset by lower cost of condensing equipment and omission of cooling-water system.

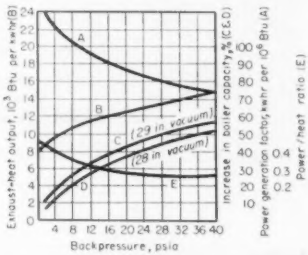
Fig. 3, 4 and 5 show several hookups for thermal electric stations. During peak-load periods or when outdoor temperature is below 40 F, temperature of heating water can be raised with bled steam or by increasing turbine backpressure. But the most efficient operating method runs turbines to give variable exhaust pressure to raise temperature of stored water during night when station electric demand is low. Increasing backpressure to 50 psi gives a 280-F water temperature. Nearly all the demand for heat is supplied by exhaust steam at most favorable operating conditions.

Exhaust-heat storage raises annual load factor. Power generated at night can be used in electrode boilers beyond the range of the district heating system. With this setup it is possible to generate power with 6000 Btu per kwhr heat rate.

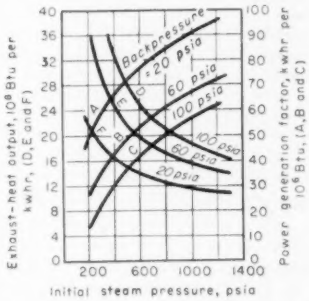
Accumulator, located some distance from the thermal electric station, has hot water pumped to it. It allows balancing of heat and electric loads. When run with an air-blast cooler in summer, the accumulator permits uniform power generation without large investment in cooling towers or large cooling ponds. There is no longer the problem of finding a good condensing site. Best economy is obtained with high initial steam pressure for turbines and circulation of superheated water for heating.

Industrial Use. One illustration shows present trends in this field. To supply power and heat to a large chemical plant a thermal electric station rated at 400,000 lb per hr, 650 psi, is now being built. Backpressure turbine rated 15,000 kw will exhaust at 200 psi to manufacturing area. Exhaust steam will provide h-p h-t water for all space and process heat. Power is generated as a byproduct; heat is what the plant "manufactures."

But where heat is needed only for space and process or where power load is light and fluctuating, controlled-circulation boilers are best. Or heat may be obtained from other sources like waste-heat boilers and incinerators. If sufficient combustible waste is available to heat water, give it serious consideration before plant installation. In Europe many towns or sections of large cities use garbage and rubbish to generate high-pressure high-temperature water.



6 **TURBINE** backpressure effect on power generation, 900-psi 850-F plant



7 **BOILER** steam-pressure effect on the generation of power in h-p h-t plant

System operation is simple. Water temperature is varied by changing boiler pressure or blending return water with supply water while keeping boiler pressure constant.

To start a h-p h-t hot-water system, slowly fill the piping with water while air cocks are open. When pipes are full, close cocks and light off the boiler. Once boiler fires are going, start system circulating pumps. At intervals open air cocks to relieve air from system. Open pump and return bypass valves and turn on cooling water to pumps. Raise boiler pressure slowly; set mixing valve at pump to desired temperature before operating pressure is reached. Bring boiler to full pressure.

ETIWANDA
Study in Station Economy

Let's take a quick look at considerations governing design of a modern steam-electric plant—and how designers make final decisions. Abstract of ASME paper by W L Chadwick, Southern Calif. Edison Co, and E H Krieg, Stone & Webster Engrg Co

► In engineering Etiwanda Station, the criteria included: (1) simplicity, ruggedness and economy consistent with reliability and over-all efficiency (2) optimum cost combinations for investment, fuel, labor and maintenance consistent with maximum availability (3) use of oil and natural gas, with future coal provision that did not mean unneeded present outlay (4) minimum investment in facilities not directly concerned with power generation.

Southern California Edison system now changing from a predominantly hydroelectric setup has need for a high-efficiency base-load steam station. System has 748 mw of capacity designed for quick load pickup. The new plant can be planned to exploit the improving load factor.

SITE SELECTION

Etiwanda site, about 50 miles east of Los Angeles, was chosen because: (1) It stands in a rapidly growing industrial area where no fuel-burning plants now serve Edison system. (2) It gives desirable dispersion of system stations. (3) It has excellent transportation facilities, rail and highway. (4) Ample makeup for cooling towers can be taken from main upper feeder of Colorado River aqueduct, good underground water can be tapped for boiler makeup. (5) Existing right-of-ways give routes for additional 220-kv circuits.

STRUCTURAL FEATURES

Climate is dry and warm. Average annual rainfall is 17.5 in., and freezing temperatures occur only a few hours per year. The outdoor design limits enclosures to control-room, administration, shop, warehouse and water-treatment buildings.

Administration building, occupied only about 40 hr per week, has a small heat pump for heating and air conditioning, while control-room building has a larger heat pump for continuous service. Individual pumps were more economical, compared to a single unit serving both buildings. To reduce air-conditioning load, sunshades built over the administration-building windows exclude direct sunlight but admit ample reflected light.

Keeping enclosures to a minimum reduces ventilation needs, saving over $75,000 for ventilating fans. "Walk-in" enclosures over turbine-generators were rejected because of excessive heating during summer. Outdoor construction saves on clean-up labor because floors and equipment can be hosed down. It is also safer for personnel.

Eliminating turbine and boiler buildings saves between $5 and $8 per kw. Construction savings are realized by casting the administration-building walls in the horizontal position from ready-mixed concrete, then tilting them up into position when cured and joining the sections. All structures are designed for a seismic factor of 0.2 g.

The 60-ton main gantry crane can handle turbine parts but not the generator stator, which will be cribbed into place.

Subsurface construction was kept to a minimum. Favorable ground conditions and carefully compacted fills made it possible to cast column footings and most subgrade concrete without forms.

CAPACITY—AN ECONOMY MEASURE

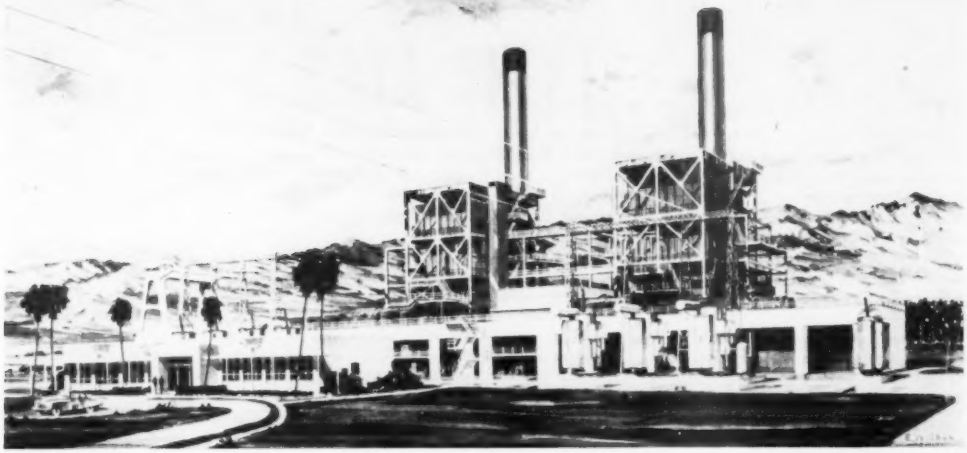
Large-unit savings led to choosing largest 3600-rpm tandem-compound units manufactured at the time, even though none was running. Incremental cost of 125- over 100-mw capability units is less than ratio 1.25:1.00. Installing two 125-mw units simultaneously meant substantial savings in engineering, purchasing, construction.

STATION-HEAT-BALANCE CYCLE

The optimum heat balance depends on many factors: operating hours per year at various loads, number of turbine exhaust flows, size of condenser and cooling tower, costs of various steam pressures and temperatures, variation in future fuel costs.

Because of frequent fouling of closed low-pressure heaters, which send 5-F terminal differences up as high as 30 F, an open deaerating heater was used at as low a pressure as would be economical. This maintains small terminal difference where it means the most. Another advantage lies in decreasing the static head between deaerator and primary boiler feed pump to: (1) eliminate heavy steel work to support heater at usual 50 or 60 ft above feed pumps when working at 50-psig pressure, (2) reduce cost of earthquake bracing for heavy deaerator at high elevation.

Deaerator connects to next-to-lowest bleed point with 1-psig pressure at 80% turbine capability. This minimizes low-load



FIRST SECTION of Etiwanda Station, Southern Calif. Edison Co, has two controlled-circulation 920,000-lb-per-hr boilers, each feeding 100,000-kw reheat turbine at 1800 psig, 1000 F, 1000 F. Outdoor design minimizes number of enclosed areas

venting problem and lowers cost of air-removal equipment.

Placing the low-pressure 6-psia closed heater in the condenser neck reduces bleed-steam line to only about 5-ft length. The decreased bleed-pressure drop equals a gain of 1 or 2 F on heater terminal differences. Station net heat rate is expected to be 9540 Btu per kwhr at 2-in. Hg backpressure.

TURBINE-GENERATOR UNIT

Detailed cost analyses determined the most economical combination of initial steam conditions, cooling-tower size, condenser size, number of turbine flows. Using cooling towers made it necessary to study economics of the combinations simultaneously. A change in any one variable affected the choice of the others. Optimum combination was: (1) initial steam conditions of 1800 psig, 1000 F with 1000-F reheat (2) triple-flow exhaust, partly justified by anticipating outputs above 125 mw (3) cooling tower with 14-F approach, giving 72-F water with 58-F wet bulb (4) 80,000-sq-ft condenser with yearly average backpressure of 1.65 in. Hg.

An unusual emergency stop-valve arrangement permits vertical and axial movement but not lateral. This both simplifies and minimizes cost of main steam leads and piping between stop and control valves.

STEAM GENERATORS

Controlled-circulation boilers were chosen on economic comparison of purchase price and cost of supporting steelwork. The 3-in. OD tubes usually furnished with 1800-psig natural-circulation boilers can work at 2010 psig. In contrast, the 1.5-in. OD tubes of controlled-circulation boilers can work up to 2332 psig. With negligible cost for thicker drums, 1950-psig superheater outlet pressure can be realized. This is 50 psi higher than for natural circulation. The additional pressure drop available for the steam leads made it possible to use 10.5-in. OD rolled tubing rather than larger diameter forged and bored tubing, costing about $150,000.

As controlled-circulation boilers use tubes of smaller diameter with thinner walls, skin temperature is less for equal rates of heat absorption than with natural-circulation boilers. Lower maintenance and higher availability is anticipated with lower skin temperatures.

Controlled circulation makes it possible to provide water-cooled spacers for superheater and reheater. This should reduce attack by fuel oils producing metallic oxides, particularly vanadium oxides. Other advantages for controlled circulation are: (1) Boiler is about 13 ft lower and about 125 tons lighter, an advantage in designing for earthquakes. (2) Restoration to service, after tube failure, is faster. (3) Ratio of steam to water passing through drum separators is greater.

Turbine bleed steam supplies coils of air heaters between forced-draft fans and main regenerative air heaters to minimize flue-gas deposits and corrosion on the cold end. This will be done the year round. Metal temperatures of main heaters will be held at an average of 215 F.

Air-soot blowers clean the cold end of air-heater surfaces. If these are not effective, the heaters can be washed under load. This will save fuel by maintaining boiler efficiency and improving boiler availability at small investment.

COOLING TOWERS

A cooling tower common to both units was designed for minimum investment and to simplify maintenance. Foundation is a plain, flat slab, even without pedestals for column bases, over which cooled water can flow to a collecting flume at one side of the tower for return to the plant. This avoids the usual basin with its cleaning difficulties.

There are unusually continuous winds of varying intensity, so the tower may collect dust, leaves, tree bark, insects. With the flat-slab base this debris can be easily hosed into the open discharge flume and removed at its central settling chamber. Small distance between the bottom cooling-tower fill and the slab will make maintenance more convenient than the usual deep basin.

Exploiting favorable wind conditions by proper tower orientation was investigated. Few data are available on isotherms on the lee side of cooling towers in any position, and on recirculation as affected by tower orientation. Other major considerations were avoidance of recirculating vapor to future towers, minimizing drip or fog effect on plant working areas. These studies led to placing four 145-ft-long sections of tower nearly normal to prevailing wind direction with 85 ft between sections. This layout should give optimum performance for the 835-ft length of complete cooling tower setup.

(*Continued on page* 102)

Cooling-tower makeup water from the Colorado has about 750 ppm of dissolved solids. This is expensive water since it is raised 1618 ft and transported more than 250 miles from Parker Dam across the desert before reaching the plant.

A treatment plant will stabilize the cooling-tower makeup water to allow higher concentration and minimize blowdown. This will be done by maintaining a suitable Langelier saturation index to avoid (1) deposition of scale on condenser, hydrogen- and oil-cooler tubes or (2) corrosion from excessive acidity.

A 1-ton gantry crane, made of piping, and traveling along the tower top, lifts and transports motors, gearboxes, or fan blades to one end of each tower section. Here they may be lowered to the ground through a trap door. This will help keep down size of maintenance crews.

CONDENSING SYSTEM

Open gunited flumes convey 140,000 gpm of circulating water. The flumes will be more economical than alternate 8- and 9-ft ID precast concrete pipe. A 40 acre-ft storage basin provides cooling-water makeup if aqueduct water supply should be interrupted. Rolled earth-filled dikes form the basin. A gunite lining prevents water loss and damage by rodents and erosion.

A large-capacity reciprocating dry-vacuum pump evacuates steam spaces rapidly. Pump will also back up the single set of steam-air ejectors and allow starting the turbine at about 100-psi steam pressure.

A rubber expansion joint between turbine and condenser avoids throwing any heavy earthquake load on the turbine exhaust hood.

FEEDWATER SYSTEM

Deaerator will run at 15 psia with turbine loaded to 80% capacity. At lower loads evacuating equipment will remove noncondensable gases.

Heaters, fed by the two high-pressure bleed points, are arranged in two parallel streams. Four small heaters proved less expensive than two large ones. Since all condensate can be passed through either stream, heater bypasses were eliminated.

STATION PIPING

Omitting gate valves between boiler and turbine saved $36,000 for the two units. Valves often cause unit outages. Providing flexibility in the main steam leads themselves, compared to rigid piping with flexible superheater outlet header, proved the former more economical. This was not true of the hot reheat piping having some 8.7-in. expansion per 100 ft. Here it proved more economical to use a flexible outlet header. But for the reheat inlet it was more economical to have a fixed inlet header.

There will be no steam or feedwater interconnections between units. Experience shows that interconnections often cause as much outage time as they save, if not more. Auxiliary steam will be used only for oil heating and normal air ejection. Air stored at 500 psig, used at 350 will do soot blowing.

Piping investment was also reduced by: (1) backfilling trenches containing bare steel pipe with oil-saturated soil (2) separate fire systems in station and at oil tanks (3) one steam heating line to oil tanks instead of two; condensate return can be used for steam supply in emergencies, wasting condensate during such periods instead of returning to boilers.

INSTRUMENTATION AND CONTROL

In the centralized control room only those instruments for controlling turbine, boiler and auxiliaries are on front of board. Recorders for historical data are on the back. The boiler-turbine boards measure only 17 ft, 3 in. long for each unit.

When both turbine stop valves close simultaneously, relays automatically decrease fuel supply by 80% to prevent reheater overheating and to maintain fires for an immediate restart without relighting. Main generator breakers open automatically after a 5-min delay.

Two television systems per boiler enable observation of all portions of 8 flames and ignition torches in each half furnace from the control room. Cameras stand in a "bay window" formed by tubes bent inward in the boiler's upper front wall.

Although essential spare pumps start automatically the control-room operator can operate them direct.

Valve control has been centralized in four areas. All valves for feed pumps, extraction steam lines and heater drainage will group on a mezzanine grade beneath each turbine. Valves to control fuel gas, fuel oil, boiler drains and boiler feed are also on the mezzanine, alongside each boiler. Valves for fuel-oil heating and condensate returns for oil heaters stand beyond draft equipment at ground level. Control for fuel-oil pumping is in a fuel-oil-pumping station centrally located between the four 130,000-bbl fuel-oil tanks.

All valves may be operated, packed or serviced without using ladders, scaffolds or auxiliary platforms. None needs extension stems or chain wheels. A few valves have floor stands.

MAINTENANCE AIDS

In a modern plant the maintenance crew is much larger than the operating. Etiwanda will meet the optimum practice of only 6 operators for two 125-mw units. Size of maintenance crew is kept down through simplifying its work by having: (1) well-pitched floors and adequate drains so they may be hosed without sweeping or using vacuum cleaners (2) portable gantrys for handling cooling-tower parts and light turbine parts (3) davits for handling heater parts (4) hoists for circulating-water screens and outdoor pumps (5) space around equipment so fork lift trucks can handle heavy parts; this minimizes expensive monorail hoists (6) galvanized open-grating platforms to eliminate floor cleaning and future painting.

UNUSUAL PROBLEMS

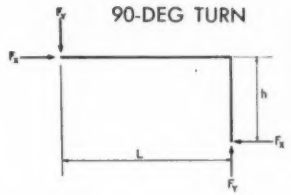
Because water from the cooling towers will have a concentration of about 3000 ppm it will not be wasted to storm drains. This avoids possible percolation into the ground-water basin. A waste-disposal system will be built in conjunction with established disposal agencies in Los Angeles County to convey all industrial waste about 50 miles to the ocean. This involves company construction of a 15-mile concrete pipeline of 5-cfs capacity to connect with existing trunk sewers in which capacity will be purchased.

Because of the large transportation savings, an 8⅝-in. OD pipeline will be built about 40 miles across country from Santa Fe with three heater pumping stations to deliver oil. Initial temperatures of 200 F will be needed to avoid excessive pressures during winter. Electrically driven reciprocating pumps will develop 800 psig for flows from 400 to 700 bbl per hr. Direct-fired tubular heaters, of the type the oil industry uses, will warm the oil at the pumping stations.

Power's DATA SHEET

No. 240

90-DEG TURN



Reacting Force $F_x = k_x \cdot c \cdot \frac{I_P}{L^2}$ lb

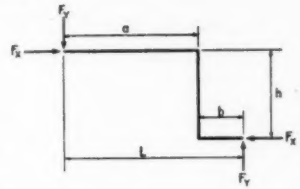
Reacting Force $F_y = k_y \cdot c \cdot \frac{I_P}{L^2}$ lb

Maximum Bending Stress $s_B = k_b \cdot c \cdot \frac{D}{L}$ psi

I_P in inches^4 L in feet D in inches

$\frac{L}{h}$	k_x	k_y	k_b
1 0	12 0	12 0	36
1 2	17 2	12 5	46
1 4	23 0	13 4	58
1 6	32 0	14 4	71
1 8	42 0	15 4	85
2 0	54 0	16 6	102
2 2	68 3	17 8	120
2 4	84 4	19 2	140
2 6	103	20 6	161
2 8	125	22 0	184
3 0	150	23 5	209
3 2	175	25 0	234
3 4	207	26 5	259
3 6	237	28 0	287
3 8	274	29 5	318
4 0	315	31 5	349
4 2	356	33 0	381
4 4	406	34 6	414
4 6	456	36 2	450
4 8	510	37 8	487
5 0	570	39 5	528
5 2	630	41 2	569
5 4	700	43 0	610
5 6	775	44 7	652
5 8	855	46 2	696
6 0	938	48 2	742
6 2	1020	49 8	790
6 4	1110	51 6	840
6 6	1212	53 4	892
6 8	1313	55 0	944
7 0	1426	56 8	997
7 2	1517	58 6	1050
7 4	1655	60 2	1104
7 6	1785	61 8	1159
7 8	1917	63 6	1219
8 0	2059	65 4	1284

Z-SHAPE



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Reacting Force $F_y = k_y \cdot c \cdot \frac{I_P}{L^2}$ lb

Maximum Bending Stress $s_B = k_b \cdot c \cdot \frac{D}{L}$ psi

I_P in inches^4 L in feet D in inches

$\frac{a}{b}$ →	1			1 5			2			3			4			← $\frac{a}{b}$
$\frac{L}{h}$	k_x	k_y	k_b	k_x	k_y	k_b	k_x	k_y	k_b	k_x	k_y	k_b	k_x	k_y	k_b	$\frac{L}{h}$
0 6	9 25	43 0	83 8	8 5	38	91	7 3	32	85	6 5	35	73	6 0	22	66	0 6
0 8	12 8	39 0	69 0	11 8	35	76	10 5	29	71	9 2	23	62	8 5	20	56	0 8
1 0	17 2	37 9	61 9	15 9	34	69	14 4	29	66	12 6	22	52	11 8	19	50	1 0
1 2	22 5	37 8	57 8	21 0	35	69	18	29	66	16 0	23	53	14	20	51	1 2
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2 8	102	58 2	109 0	96	53	110	91	46	105	82	35	92	80	30	87	2 8
3 0	116	62 2	116 1	110	56	118	104	49	115	92	37	99	90	32	93	3 0
3 2	132	66 0	124 5	124	59	126	118	51	121	106	39	107	104	34	99	3 2
3 4	149	70 0	133 0	140	63	134	133	54	128	121	41	114	118	36	105	3 4
3 6	168	74 0	141 0	158	66	143	149	57	135	136	44	120	132	38	111	3 6
3 8	188	78 0	149 0	177	70	151	165	60	142	151	46	127	147	40	117	3 8
4 0	210	82 0	157 8	197	73	159	181	63	150	166	49	133	163	42	124	4 0
4 2	235	86 4	166 0	219	77	168	201	66	157	185	51	140	182	44	130	4 2
4 4	260	90 6	174 5	241	81	177	221	69	164	204	53	147	201	46	137	4 4
4 6	285	94 8	183 0	263	85	186	241	72	173	223	56	154	220	48	143	4 6
4 8	310	99 0	192 0	287	88	194	263	75	182	243	58	161	239	50	150	4 8
5 0	336	103 2	201 4	314	92	203	288	78	190	264	81	168	260	52	156	5 0
5 2	364	107 6	210 0	341	96	212	313	81	198	286	63	175	281	54	163	5 2
5 4	393	111 8	219 5	370	100	221	339	85	206	310	66	182	304	56	169	5 4
5 6	425	116 2	228 0	399	104	230	365	88	214	335	68	189	329	58	176	5 6
5 8	457	120 5	237 5	430	108	239	392	92	223	360	71	197	355	61	182	5 8
6 0	491	124 8	245 5	461	112	248	422	95	232	386	73	205	381	63	190	6 0
6 2	526	129 4	254 5	493	116	258	450	98	240	414	76	212	408	65	196	6 2
6 4	562	133 8	263 5	526	120	267	478	102	248	443	79	219	436	67	203	6 4
6 6	598	138 2	273 0	561	124	276	506	105	256	472	81	227	465	69	210	6 6
6 8	633	142 6	282 0	598	128	285	535	108	265	502	84	234	493	72	217	6 8
7 0	670	145 0	287 0	636	132	294	565	111	274	533	86	242	526	74	224	7 0
7 2	715	152 0	300 0	674	136	303	601	115	282	565	89	248	557	76	230	7 2
7 4	758	156 5	309 0	714	140	312	639	118	290	599	92	256	588	78	237	7 4
7 6	803	161 0	319 0	756	143	321	680	122	299	633	94	263	620	81	244	7 6
7 8	850	165 5	328 0	798	148	330	724	125	308	668	97	270	655	83	250	7 8
8 0	898	170 0	337 0	840	152	340	770	129	317	703	99	279	694	85	257	8 0

Tables for Figuring Pipe Shape

By S W SPIELVOGEL, *Asst Div Engineer, Consolidated Edison Co of New York*

► THESE TABLES, reprinted with permission of Grinnell Company, Inc, from *Piping Design and Engineering*, permit easy figuring of 90-deg turns and Z-shapes. (See pp 96-99, POWER, Nov 51, for the first article in this series. Methods used here are similar.)

Example. Find anchor forces and stress in a 6-in. Schd 40 carbon-steel pipe operating at 600 F when distance between terminals is 51 ft.

Solution: 90-deg turn, $L = 50$ ft, $h = 10$ ft, geometrically fits the job. Using equations in table, $F_x = (570) \times (701) \times (28.1) \div (50)^2 = 4500$ lb. $F_y = (39.5) \times (701) \times (28.1) \div (50)^2 = 312$ lb. Bending stress $= (528) \times (701) \times (6.625) \div 50 = 49{,}200$ psi. This is excessive; 90-deg turn cannot be used.

For Z-shape, $a = 40$ ft, $h = b = 10$ ft. Then $L/h = 5$, $a/b = 4$. $F_x = (260) \times (701) \times (28.1) \div (50)^2 = 2050$ lb. $F_y = (52) \times (701) \times (28.1) \div (50)^2 = 410$ lb. Bending stress $= (156) \times (701) \times (6.625) \div (50) = 14{,}500$ psi. This stress is in limits for power piping.

Symbols. All dimensions in feet except outside diameter of pipe, D, which is in inches. Anchor forces, F_x and F_y are in lb, bending stress, s_B in lb per sq in.; c = expansion factor = (expansion, in. per 100 ft) × (E) × (M_B) ÷ 172,800. (Table for c will appear in a future article. Look for it.)

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BIRD & SON inc.
BIRD PRODUCTS
Established 1795

very much pleased with

Bird & Son, one of the countries outstanding manufacturers of roofing and building materials, linoleum, shipping containers and other paper products, recently modernized their East Walpole power plant by installing a 175,000 lbs. hr. Riley single header hopper bottom pulverized coal-fired boiler unit and a 5000 K.W. generator.

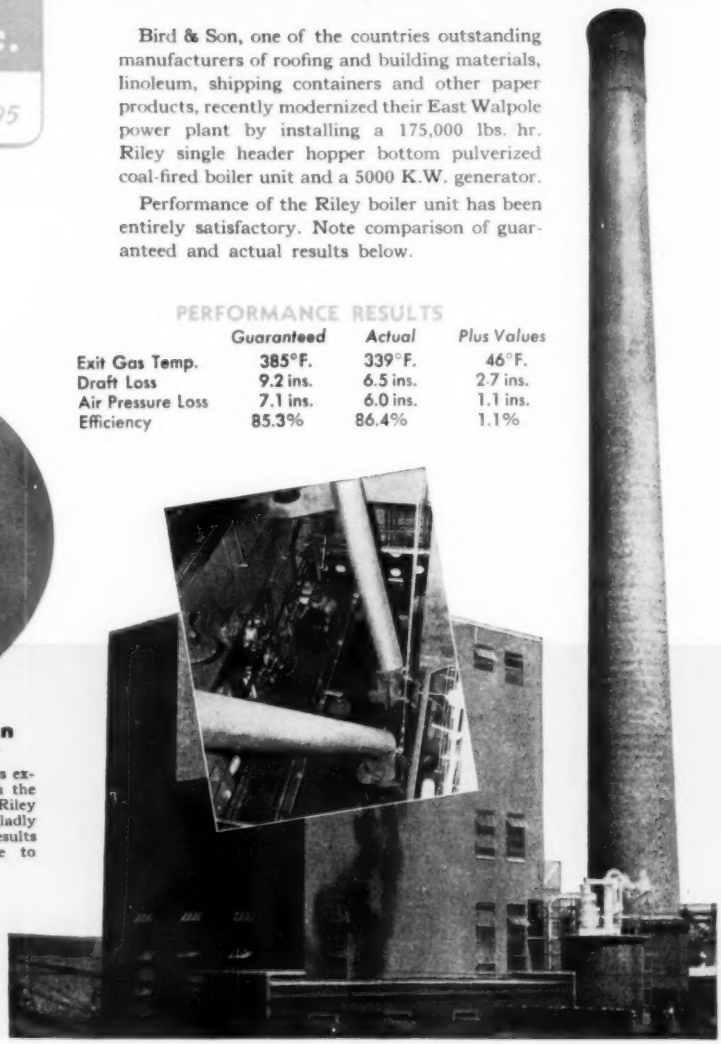
Performance of the Riley boiler unit has been entirely satisfactory. Note comparison of guaranteed and actual results below.

PERFORMANCE RESULTS

	Guaranteed	*Actual*	*Plus Values*
Exit Gas Temp.	385°F.	339°F.	46°F.
Draft Loss	9.2 ins.	6.5 ins.	2.7 ins.
Air Pressure Loss	7.1 ins.	6.0 ins.	1.1 ins.
Efficiency	85.3%	86.4%	1.1%

Robert C. Holman
Plant Engineer

Mr. Holman advises he is exceedingly well pleased with the performance of the new Riley unit. We are sure he will gladly tell you of the excellent results he obtained if you care to inquire.



BIRD & SON, INC.
New Power Plant
East Walpole, Mass.

RILEY

STOKER CORPORATION, WORCESTER, MASS.

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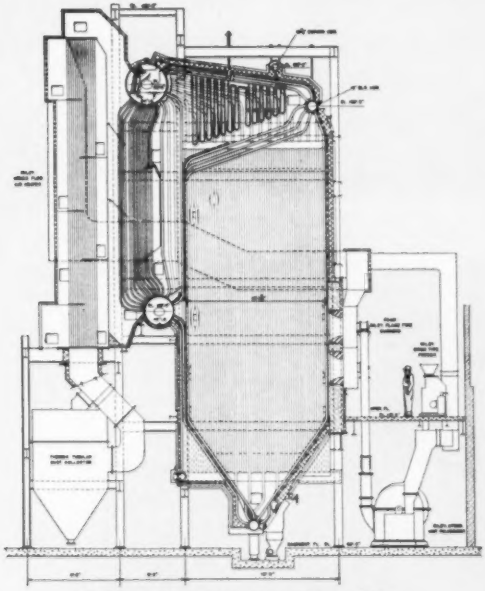
results from their new Riley boiler unit

Riley Single Header Hopper Bottom Units save You money by

1. Reducing height of building required by as much as eight feet
2. Permitting installation of higher capacity unit in existing building
3. Eliminating cost of separate ash hopper
4. Eliminating cost of ash hopper seals and drip castings



BIRD & SON, INC., East Walpole, Mass.
RUST ENGINEERING CO., Engineers
175,000 lbs./hr. 710 lbs. pressure. 750°F. total Steam Temperature pulverized coal-fired single header hopper bottom Riley Units.

108 Riley Single Header Hopper Bottom Units Installed. Total Capacity 17,503,000 lbs. of steam per hour.

All of these well-known Companies have ordered Riley Single Header Hopper Bottom Units.

- United States Steel Corp.—8 units
- Esso Standard Oil Co.—5 units
- Chase Brass & Copper Co.
- South Carolina Gas & Electric Co.
- Pratt & Whitney Co.—7 units
- Western Electric Co.—3 units
- Monsanto Chemical Co.—2 units
- Norton Company
- Hanna Furnace—4 units
- Celanese Corp. of America—6 units
- Regel Textile Corp.—2 units
- American Viscose Co.
- Great Lakes Steel Corp.
- Cluett Peabody Co.
- Waldorf Paper Products—2 units
- New Orleans Public Service Co.
- U. S. Rubber Co.—3 units
- Continental Can Co.
- Utah Power and Light Co.
- Gould Paper Co.—2 units
- South Carolina Public Serv. Auth.—2 units
- Syracuse University—2 units
- Dairyland Power Co-op.—3 units
- Hooker Electro Chemical Co.—3 units
- Superior Water, Light & Power Co.
- Whippany Paperboard Co.—2 units
- Rayonier, Inc.
- U. S. Finishing Co.
- Northern Paper Mills—2 units
- Cities Service Corp.
- Calumet & Hecla Consol. Min. Co.
- Otter Tail Power Co.
- Swift & Co.
- C. H. Masland & Sons
- Upper Mich. Power & Light Co.
- Los Angeles Water & Power Dept.
- Champion International Co.
- Central Ohio Light & Power Co.—2 units

*These companies have placed repeat orders

A survey of your Power Plant by a consulting engineer will possibly show ways of making surprisingly large savings in your power costs

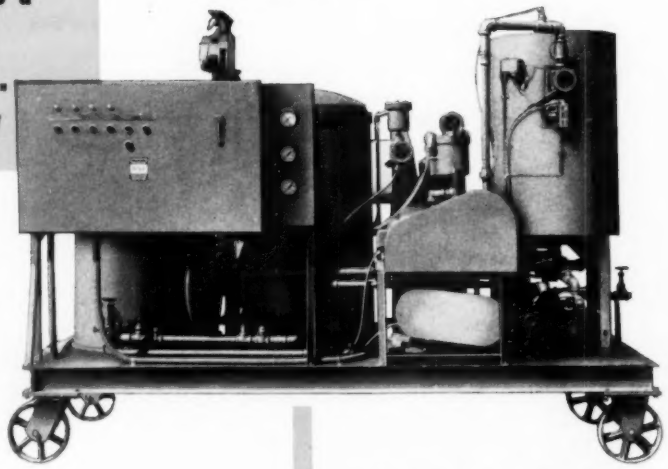
COMPLETE STEAM GENERATING UNITS

. . . it will pay you to visit modern Riley Installations before purchasing Boiler or Fuel Burning Equipment

ECONOMIZERS • WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • AIR HEATERS

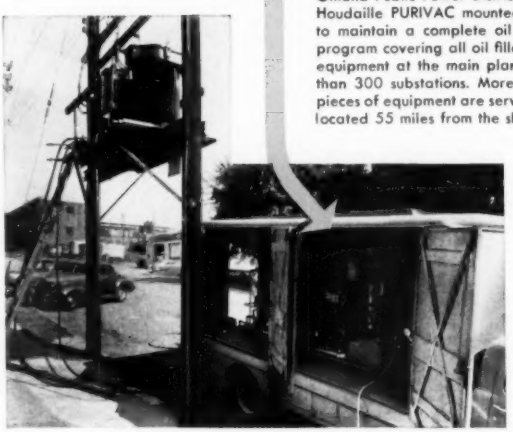
Houdaille Purivac Insulating Oil Purifier

the ONLY mobile oil purifier that does a complete job in one automatic operation.. with complete safety



1. Performs complete purification, dehydration and degasification. No blotter press required.
2. Performs equally well in the field or at a central station. Low operating cost.
3. No service interruptions. Purifies oil while transformers, circuit breakers, etc., are in operation.
4. Automatic, interlocking safety controls insure complete protection.

A regular program of PURIVAC oil purification reduces power failures and equipment damage caused by deteriorated oil. Utilities and power plants have proved that PURIVAC preventive maintenance prolongs the useful life of oil . . . eliminates costly transformer cleaning operations . . . restores color, neutralization number and dielectric strength of oil.



Omaha Public Power District employs a Houdaille PURIVAC mounted in a truck to maintain a complete oil purification program covering all oil filled electrical equipment at the main plant and more than 300 substations. More than 1200 pieces of equipment are served . . . some located 55 miles from the shop.

Only HOUDAILLE PURIVAC gives you this complete oil purification service. Write today for special bulletins giving complete information, specifications, case histories, laboratory reports, etc.

All Honan-Crane equipment is sold on a performance guaranteed basis

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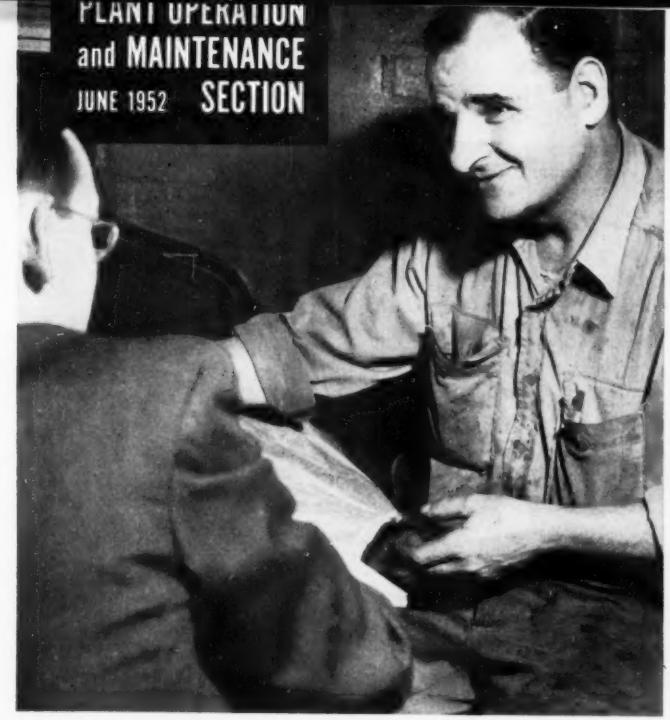


Plant Savvy Pays Big for GLOBE Dye Co

My old friend George Edwards, over coffee one night, advised "Get around and see your neighbor's plant. You'll learn plenty you can put to work."

That's just what we're doing here. First visit is to Philadelphia plant of Globe Dye Works Co where ex-Navy chief George Hogg is the "four striper."

George is a topnotch operator who does plenty of thinking and planning for his plant. In complete charge of all operation and maintenance, he's always on his toes for new equipment and ways to step up production.

Right now, George is wrapped up in a new boiler he ordered, but he still has time to think of his 225 motors, air-conditioning, sprinkler and pumping systems. Globe works most on cotton, synthetic and novelty yarns.

MEN OF ACTION George Hogg, chief engineer, Globe Dye Works Co, *above*, talks with Associate Editor Ty Hicks. *Below*, Ty talks to Otto Peyer, chief engineer of Hellwig Dyeing Corp

...and for HELLWIG Dyeing Corp

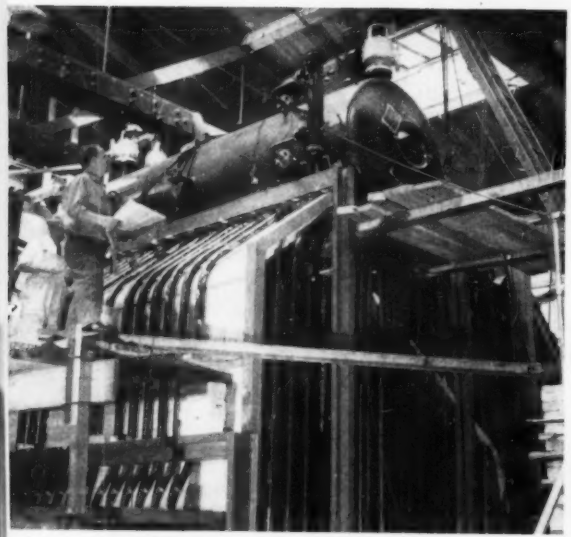
Specialties for Hellwig, a neighbor of Globe, are nylons, acetates and silks. Otto Peyer, chief engineer, has charge of all mechanical maintenance in his large plant. He has 35 maintenance men and operators in his department.

Says Peyer when talking of running a plant, "You've got to know your plant, the men in it, what they can do. Keep accurate records—they're good convincers when you talk to management. Get along with your boss. If you can prove your point in dollars and cents, you'll seldom have trouble getting new equipment you need."

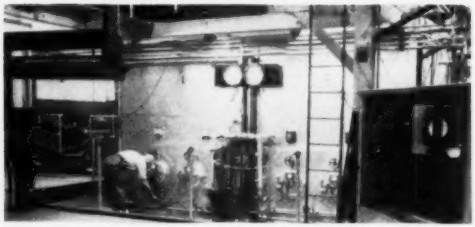
This thinking and approach pretty well summarize that of George Hogg, too. Peyer and Hogg, two men of action in big textile plants.

For the story in photos, turn page ▶

GLOBE SPECIALIZES IN DYEING AND FINISHING COTTON, SYNTHETIC AND...



NEW B&W BOILER, 40,000 lb per hr, gets careful inspection by Hogg. Boiler control is from Bailey Meter board. New unit will give Globe plenty of steam capacity, cut outage danger

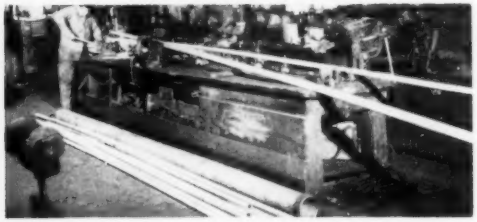


ONE OF TWO Union Iron Works boilers, each 20,000 lb per hr, that have supplied steam to Globe many years. These will stay on the job with new B&W unit because steam load is up

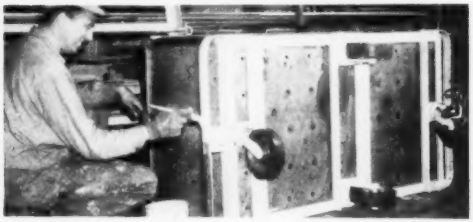
PIPE SHOP combined with machine shop is where Hogg's men do much maintenance, like rebuilding feed pumps, cutting and threading pipe for the 22 plant buildings occupying 4 blocks

HELLWIG HAS A BIG PLANT SPECIALIZING IN NYLONS, RAYONS, ACETATES...

OTTO PEYER, Hellwig's chief engineer, believes in working closely with his men. Here he gives repair instructions for part of a textile machine. Peyer runs all mechanical work



PIPE SHOP in which new and replacement lines are made up for the 40 buildings in plant. Besides this pipe shop there are the machine, welding, sheet-metal and carpentry shops



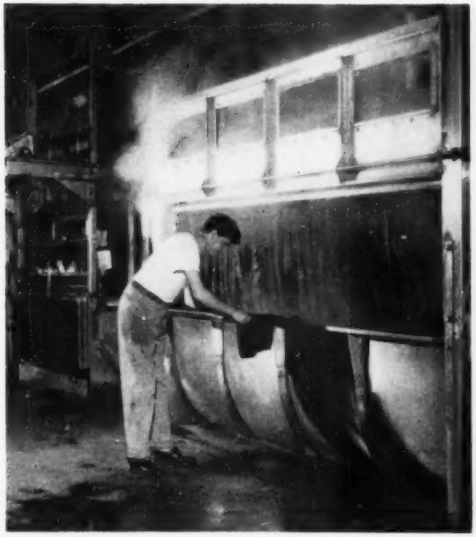
DYE TRUCK maintenance and painting are part of Peyer's job. He has 35 men in his operating and maintenance department. They take care of 250 traps, 50 unit heaters, textile units

...NOVELTY YARN. ITS 22 BUILDINGS OCCUPY FOUR CITY BLOCKS IN PHILLY

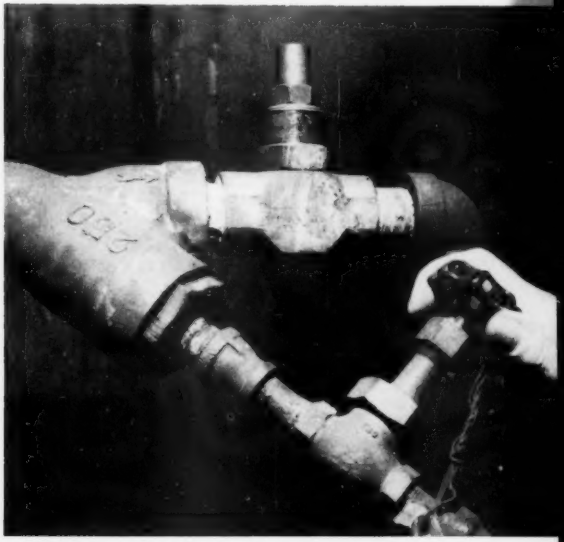
AIR-COMPRESSOR room has 90-cfm Ingersoll-Rand unit for day loads and 10-cfm I-R compressor for night. Clarence Hands, one of Hogg's ten operators and maintenance men, checks oil

YARWAY BLOWDOWN VALVES get first shot of grease. The total steam load at Globe is now 60,000 lb per hr. Zeolite softeners handle 250,000 gal of water per day for the plant

...AND SILKS. THE WORK IS DONE IN 40 BUILDINGS THAT MAKE UP THE PLANT



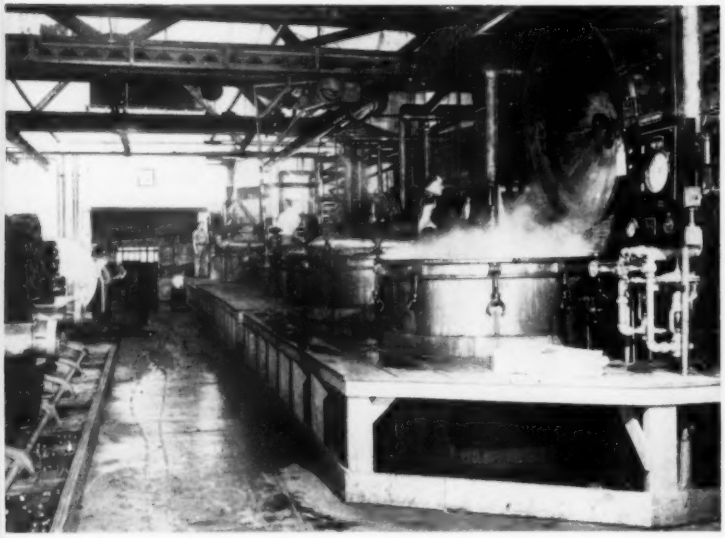
STAINLESS-STEEL covered-type dye box dyes batches of cloth in rope form. This is only one of the 85 dyeing machines Otto Peyer has in his plant. About 600 people are employed



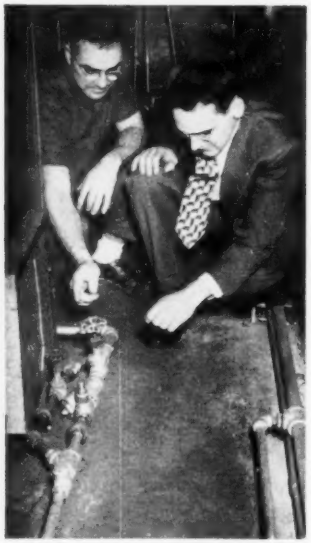
BLOWDOWN ahead of impulse steam trap allows easy cleaning of strainer. Riley Stoker boiler generates about 85,000 lb of steam per hr for process needs. The current is purchased

More on next page

SURE, GLOBE HAS A WELL-RUN PLANT BECAUSE GEORGE HOGG BELIEVES...

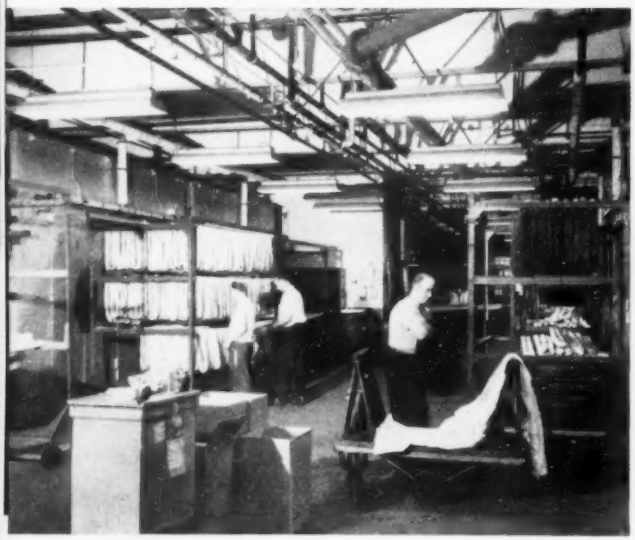


PACKAGE DYE HOUSE has machines with capacities ranging from 50 to 1000 lb. View here shows only a few of the many automatically controlled units George Hogg must keep on line. Each machine has motor-driven pump, steam and condensate lines



TUBE-DRYER trap connections are shown to Ty Hicks by Leonard Akers, foreman of department. Note the neat piping used

AND HELLWIG'S TEXTILE PROCESSING AND FINISHING MACHINES ARE...

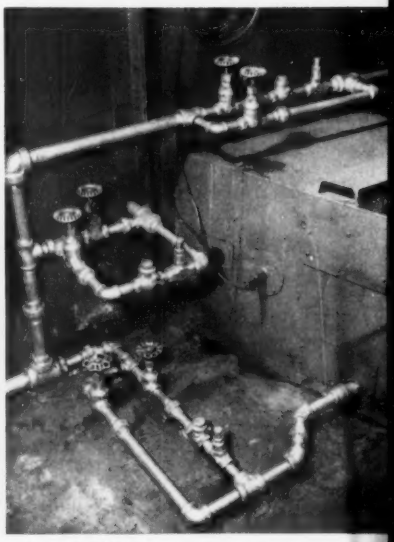


SKEIN DEPARTMENT loads dryer racks. Trucks, racks, dryers and all the mechanical equipment in this and other departments are Otto Peyer's responsibility. He keeps them running smoothly by practical know-how

SMALL UNIT HEATERS dry dyed cloth samples so the dyers can see that color is right and lasts. Big textile mills are constantly testing their product

...IN SCHEDULED MAINTENANCE, HUSKY EQUIPMENT AND REGULAR CHECKS

DRYER OPERATOR checks yarn condition in Proctor & Schwartz tube dryer. George Hogg must keep six units like this running day and night. This one has 3000-lb capacity, is fitted with motor-driven fan, steam heating coils, condensate connection



HOGG BELIEVES in topnotch piping as this photo of Yarway impulse traps on 1000-lb Smith-Drum cotton dryer shows

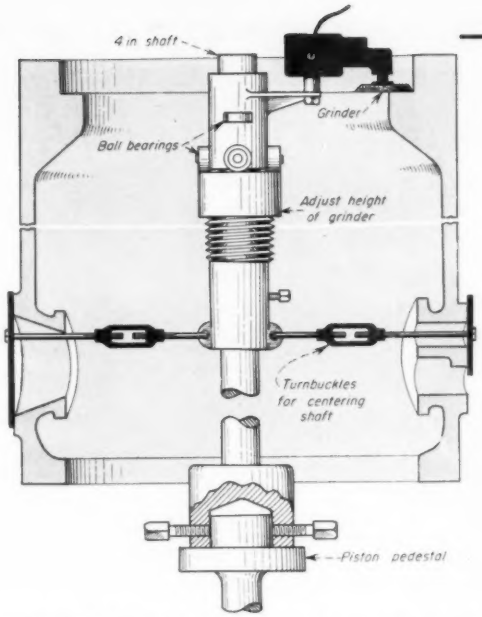
...BIG PART OF OTTO PEYER'S JOB. KEEPING THEM ON LINE TAKES SAVVY

OPERATOR REGULATES condensate flow from tenter frame handling 50 yd of cloth per min. There are seven tentering frames at Hellwig. Note the exhaust

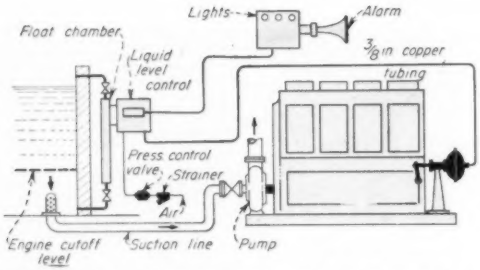
AIR-LAY TYPE dryer, Proctor & Schwartz, being started. This unit runs about 45 yd per min of spun-rayon cloth with resin finishes. The dryer is automatically controlled and has much auxiliary equipment

HANDY DIESEL REPAIRS

Here are four practical ideas that were learned the hard way. See if you can cash in on them in your plant



DIESEL LINER SEAT is built up with welding rod, then ground to original size with homemade grinding rig (see facing page)



FOOLPROOF control system stops diesel if the liquid level being pumped gets low or if instrument's air pressure fails

PROTECT DIESELS... Automatic devices now will save costly grief later on, and pay their keep many times

► I HAD TO DEVISE a protective control system for a diesel-powered booster pump station. Water came from a settling basin. Original plans specified constant operation of diesel with flow controlled by throttling the pump's discharge.

This called for a large, diaphragm operated control valve, a very expensive item. But if settling basin went dry, the pumps would be ruined fast. As station was in jungle, run by unskilled native help, I needed foolproof protection.

Settling basin was equipped with a pneumatic liquid-level controller. This was piped to a pneumatic diaphragm-actuated damper-operating mechanism, mounted directly on the diesel engine's frame. Plunger operated and controlled the diesel engine's fuel-feed lever.

As basin level fell, pump speed reduced proportionately, so basin's feed pumps could restore water level.

Operating diesel engines at greatly reduced speed usually clogs fuel jets. Control setting had to be adjusted so diesel engine's control lever would trip to OFF position before this unsatisfactory operation was reached.

Since our control system was operated by liquid level, I had to set up basin level against rpm of engine. Then set the engine cutoff at a predetermined basin low-level position on liquid-level controller. The attending mechanic would restart pumps manually.

Control system is hooked up so failure of instrument's air supply to either liquid-level controller or the diaphragm-operated damper control, or to both, stops diesel engine.

Liquid-level controller is also equipped with an electrical high- and low-water alarm, operating signal lights and a horn. Reports from field indicate that this system is operating OK.

A M PALMER *Brooklyn, N. Y.*

HANDY GRINDER... Keeps the cooling water out of cylinder by resurfacing joint face

► We have three 3750-hp 2-cycle diesels. These engines have a 30-in. bore and a 42-in. stroke. They have crossheads and are equipped with removable cylinder liners. Joint, between cylinder's top and lip on top of liner, is flat, sealed with a copper gasket.

Seats on cylinder and liner have worn away so water leaks between them. To repair, we pull liner, and machine its seat on a lathe. While liner is out, we build up seat on cylinder by electric welding, using a low-temperature rod for bond; nickel arc rod for buildup.

To machine seat, we use portable grinder, sketch (facing page). Vertical shaft has two movable collars and one stationary, to which four arms are attached. Arms are adjusted by turnbuckles for centering shaft in cylinder. Shaft is centered with a dial indicator against machined cylinder parts.

Stationary collar has a nut on top, which can be screwed up and down to adjust height of upper bearing collar supporting grinder. This bearing collar runs on ball bearings, both against shaft and against adjusting nut.

To this collar we fasten an arm and bracket, and two straps to hold a 90-degree-head portable grinder. Use a cup grinding wheel, and slowly push the grinder around shaft, so new flat seat is ground on cylinder. Height of grinder is adjusted by ring that screws on stationary collar. By careful measurement, cylinder seat can be returned to its original height, or its height adjusted to replace amount machined from liner lip.

J R Beavers *Tucson, Ariz.*

Editor's Note: *Wouldn't it be simpler to use a sleeve bearing to revolve on shaft, with a simple thrust-type ball bearing under it? Lots easier to make.*

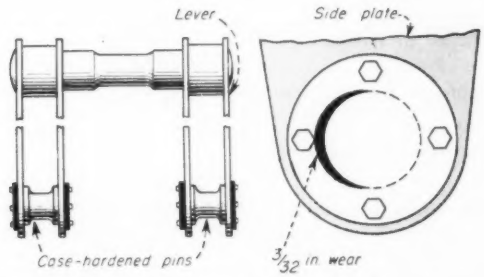
NO GREMLINS?

What else could cause an unbelievable thing like this to happen to our large diesel?

► Our 1000-hp 4-cycle 8-cylinder valve-in-head engine started acting up, so we shut it down. On inspection, we found No. 6 cylinder's exhaust valve had mushroomed and fallen off. This had happened on same engine once before, but piston had hammered valve into a round ball. This time, pieces of the pounded valve head were blown from cylinder to cylinder. Twin plugs on No. 7 and 8 cylinders had also been damaged.

We installed a new liner and cylinder head, then put engine on trial run. Before long, cylinders No. 1, 2 and 3 stopped firing. So we again shut her down and started looking for the cause. And we sure found it. The gremlins had come back, because the plugs were shorted. This proves the unbelievable fact that pieces of metal are blown from cylinder to cylinder. Don't ask how.

F J Ardolino *Brooklyn, N. Y.*



DRIVING LINKS of compressor have soft-steel lever and case-hardened pins. Wear of the lower holes caused a bad knock

LOOSE PIN?... Temporary repair with old files saved the day until regular annual overhaul

► A steady click from the compressor crosshead driving links developed into a major knock. Chief was disgusted because he'd have to shut down.

Engine was a 6-cylinder single-acting air-injection 4-stroke diesel of 2000 bhp. Its 3-stage air compressor was driven by levers of No. 1 engine and operated around the clock for seven days a week.

Engine had run for only a month since last stop period, and had some months to go. No one was happy when the Chief decided to stop the engine. He wanted to make the repair quickly.

Being a forced-lubrication job, we had to remove oil-deflector plates to get at driving-link brasses. Even then, brasses were none too handy. But we did the job and found bearing clearance OK.

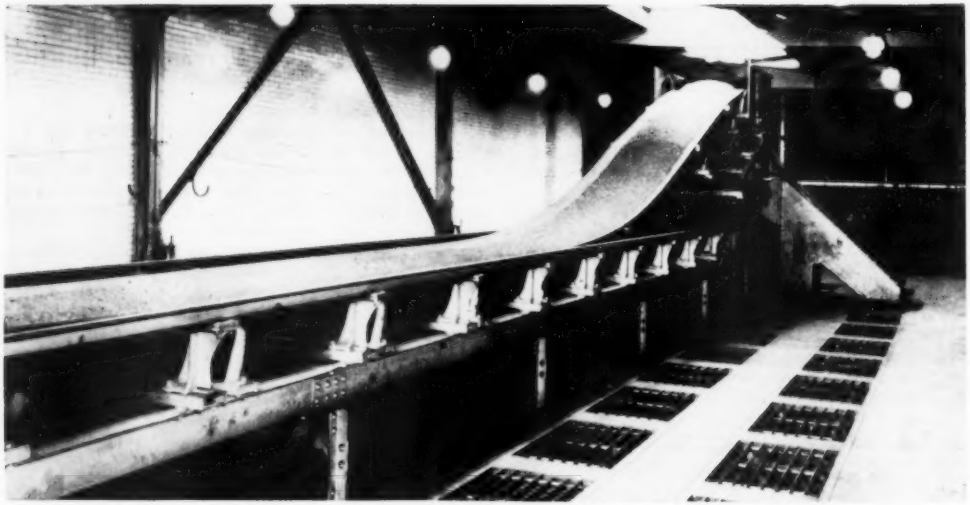
Next thing was to check driving pins in levers. Sure enough, one had worked slack and elongated holes in the mild-steel lever side plates, sketch.

There was only time for quick emergency repair because engine was needed. With only a small drill press, lathe and grinder, we had to think fast.

Since all wear was on thrust at bottom side of hole, it was a job of filling up a crescent-shape hole. We took three flat 6-in. files and ground them into small steel wedges. These were driven in between case-hardened pin and mild steel lever side plates, then broken off flush.

This repair lasted many months. When engine was finally shut down for overhaul, we built up lever and remachined the hole to provide a driving fit for pin. Repair-shop gang agreed—after much cussing—that they had never tried to withdraw a pin that was so well secured.

D A Herron *Montreal, Canada*



COAL MOVEMENT from storage to hopper has to be smooth, uninterrupted. Conveyor belts, properly designed and operated, give clean handling, without allowing spillage or jamming up along the way. Maintenance keeps these belts in operation

Giving Long Life to Belt Conveyors

- ***Discharge coal onto belt at same speed, in same direction as belt moves***
- ***Cushion lumps on a prelaid layer of fines***
- ***Hold falling distance from chute to belt as low as possible***

By **NEWELL PERRY**, *Belting Engineer, Thermoid Corp*

► CLEAN, UNINTERRUPTED coal handling goes a long way toward giving solid fuel the convenience of gas and oil. The conveyor belt figures prominently in this job. It proves a highly valuable link in moving coal from storage to boiler. But it's only as good as operation and maintenance make it.

Operation. The loading point is a major danger zone. It ought to be recognized for what it is right at the design stage. The important step is to see that coal comes on the belt moving in the same direction and at the same speed as the belt, figure, top of facing page. Where this isn't done, belt suffers at the loading point from abrasion and shock and its life is shortened.

If the incoming coal runs lumpy, try to cushion the belt by depositing layer of fines. A screen or "grizzly" at the bottom of the loading chute or, in some instances, an oval or "fishtail" notch cut in the lip of the chute deposits a layer of fines over the belting. This cushioning layer saves the belt from unnecessary bruising.

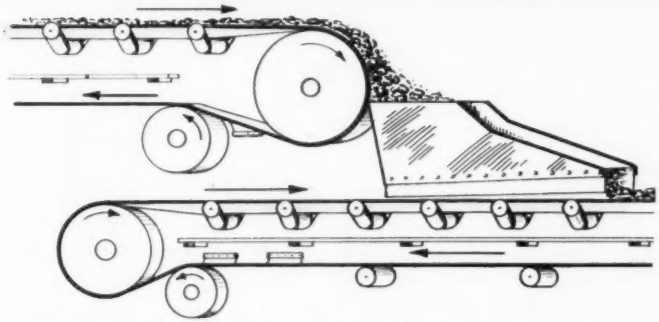
How do you go about controlling velocity of oncoming coal? Surest way is to pitch the loading chute properly. Sometimes this won't work. But you can get around the problem by setting up a baffle of iron or wooden bars, lower figure on facing page, right in the chute. This will reduce the speed of coal flow onto the belt. One word of caution: Be sure the speed stays fast enough so you deliver the needed quantity.

Unless you keep the falling distance between chute and belting as low as possible, you can lose the effect of your chute speed control. Any falling piece will pick up speed as it moves through the air. What's more, impact of the piece against the belt and the abrasion set up, when the belt changes the coal piece's direction, shortens belt life.

Whatever you do, never let incoming coal land on a belt directly over a solid pulley. The hammer-anvil action makes short work of the belt material. Spot the chute so oncoming coal lands between idlers. Some industries that load very heavy materials on belt conveyors do it directly over rubber-covered or pneumatic idlers.

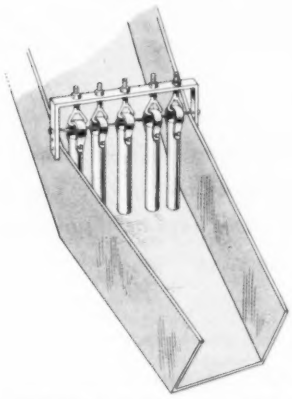
Another operation point to look for is

PROPER SUPPORT IS VITAL TO LONG BELT LIFE

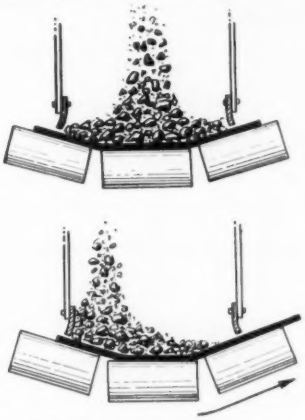


CORRECT LOADING on moving conveyor belt employs idlers near chute to prevent "spanking" or "chattering" to a point where coal escapes under the skirt boards

CONTROLS FOR SPEED AND LANDING OF COAL HELP



SIMPLE METAL or wooden bars hung in path of sliding coal slow its speed down



DELIVERING COAL to belt center allows the full belt surface to carry the load

belt vibration set up by coal impact. Chattering can depress a belt enough to let material escape under the skirt boards. To solve this one, locate the chute so incoming coal strikes the belt far enough ahead of the tail pulley to let you put in at least one belt-steadying carrier pulley. It's a smart idea, also, to put pulleys in carrier with closer spacing around the loading zone to absorb the impact of oncoming coal.

Loading-chute skirt boards and flexible skirts serve as belt-loading aids. Make the skirt board long enough to settle the coal before it leaves the loading area. With some materials a flexible skirt joins on to the board and reaches down to touch the moving belt. These flexible skirts are made up preferably from rubber-covered edges of belting remnants. Their sole purpose is to prevent spillage around the loading point. Any wedged-in lumps can work free under the forward motion of the belting.

Maintenance. Biggest enemies to belt life from a maintenance standpoint are weather, cuts, gouges—in that order. Once cuts show up repair them as fast as possible.

Belt fabric exposed to the weather absorbs moisture if the protective cover suffers damage. In extreme cases the fabric becomes thoroughly soaked. If the weather is warm, mildew and rot set in. If it's winter, ice crystals form in the fabric and gnaw from within as the belt flexes. Immediate repairs not only heal the breach but stop spread of water to otherwise sound fabric.

Tools for belt repair are simple: cobbler's knives, a stone to keep them sharp, a supply of emery cloth, rubber cement, inner-tube patching rubber, rip plates, standard belt fasteners and accessories, some rags, and gasoline for cleaning. Each time you put in a belt keep the remnants—they'll prove useful in later repairs.

Here's how you use repair tools for long and deep cuts in the belt reaching through to the fabric. Open the cut, clean out all dirt and cement it closed Allow the cement to dry thoroughly before you put the belt back in service.

Where bits of torn cover leave exposed spots with only slight damage to the fabric, remove the loose ears of cover stock by carefully cutting a curved and bevel-edged area around the spot. Then sand the edges, apply cement, let it dry, apply a tire-patching rubber and, finally, skive the patch flush with the belt cover.

If longitudinal rips or gouges penetrate the belt, clean, sand and cement these points. In addition, reinforce the longitudinal rips with rip plates at 3-in. intervals. Transverse rips require similar treatment but with standard belt fasteners instead of rip plates.

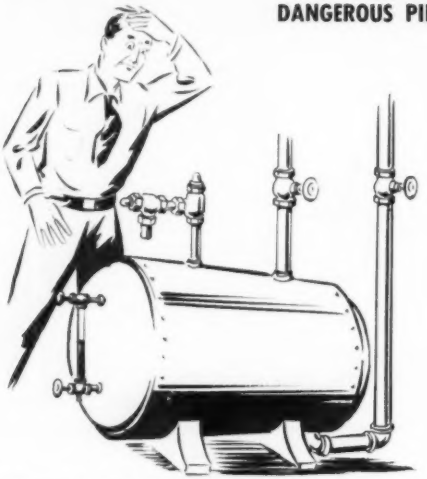
When you run into a job where holes in the belting make it impossible to use rip plates and fasteners, cut the hole out in the smallest possible rectangle you can. Hold the sides parallel to and at right angles to the belt edges. From your stockpile of belt remnants, cut an exact fit for the rectangle, insert it and fasten with belt fasteners all around patch. Cement all of the edges very thoroughly.

To make certain no fines seep through the repair spots, remove one ply of fabric from a belt remnant and place it under the fasteners and rip plates.

Vulcanized Patches. There's no doubt about it, vulcanized patches are better than the ones just described. But you'll have to add a portable vulcanizer, rubberized fabric, tie gun, cover stock, a one-ply knife and fabric pliers. In preparing a vulcanized patch, work down into the damaged belt as far as needed by pulling out progressively smaller blocks of fabric with each successive ply. Clean, rough and cement the cavity, neatly fit in new blocks of fabric and finally apply the uncured cover. Skive the edge of the patch flush, and vulcanize.

You'll never make these patches successfully unless the belt is dry. Internal moisture changes to steam blisters during vulcanizing. However, only large conveyor-belt users find vulcanizing necessary for belt patches, and splices.

DANGEROUS PIPING AND PLUGGED LINES IN CASE NO. 1



ONE SAFETY VALVE on ammonia receiver leaked, so operator picked a rusty valve out of the scrap and hooked it in series

LITHARGE PASTE was slapped on outside threads and also on inside threads until hardened lumps inside blocked the flow

Spotting Trouble

. . . is an everyday job for this consulting engineer. Here are two refrigeration cases from his notebook that cost the owners plenty of money. Both headaches could have been prevented

By C T BAKER, *Atlanta, Georgia*

► YOU MAY NOT THINK haywire hookups and operating practices are common, but I run into them all the time. It seems that many ice and refrigeration plant managers feel anyone can run their plants. So they pay a high price for maintenance and wrecked machinery every year.

Here are two cases to open your eyes. See if you can spot similar mistakes in your plant after reading these.

CASE NO. 1

A number of cold-storage rooms were added to a new building of a 50-ton capacity ice plant. To handle this new refrigeration load two 10-ton compressors were purchased. Unit coolers were suspended type, installed in the storage rooms. Two horizontal shell-and-tube condensers and a liquid ammonia receiver completed the equipment. But because of inexperienced help, this simple plant gave plenty headaches.

Safety Valves. For instance, the liquid receiver had two safety relief valves. These were not the ASRE dual safety valves, which are a great improvement over the earlier ammonia safety valves.

I learned that a new safety valve on the receiver shell had popped. From then on, failing to seat properly, it leaked slightly. To correct this, the plant engineer connected a second safety valve IN SERIES with the new valve. That stopped the leak, all right.

The curious thing about this heroic act of the plant engineer was that, while the new valve was set to relieve at 275 psi, the second valve showed no markings to indicate at what pressure it was set to open. Besides, it was found on a scrap pile, old and rusty. So the safety valve next to the receiver could not function unless the old valve opened—if it ever did.

With no high-pressure cutout to stop the two compressors, if condensing-water pump failed, this condition was a serious explosion hazard.

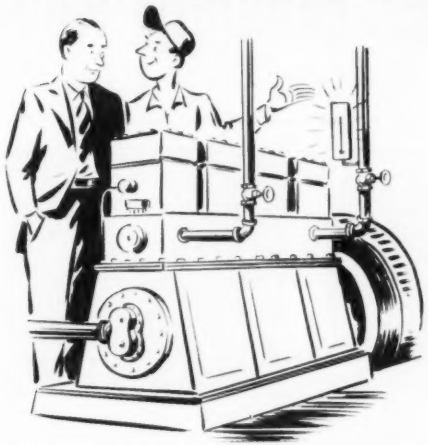
When I explained the potential danger of this booby trap, the owner said he'd have to wait for a more favorable time. He couldn't AFFORD to shut down for changes until later.

Flooded Compressor Mystery. In connecting several unit coolers to main suction pipe, a solenoid valve is placed on the liquid line near each unit. Valve is so wired that it closes when room temperature reaches the predetermined lower limit. It opens again when temperature rises to the set upper limit. With closing of last thermostatically controlled solenoid valve, the compressor operating at that time is stopped. This standard practice is almost universally followed.

But in hooking up the larger room of this group, the solenoid valve should have been placed on the suction outlet rather than the liquid inlet line. Result was that, while the thermostat cut out this room cooler, the solenoid valve closed. But the thermal expansion valve, not being designed to seat tightly, allowed enough liquid to pass into the unit to eventually fill the coil solid with liquid ammonia.

When this room called for refrigeration, the solenoid valve on the suction outlet would open and flood the compressor. This was especially bad when solenoid valve opened as compressor

COLD-ENGINE TEMPERATURE AND PLUGGED HOMEMADE AIR STRAINER IN CASE NO. 2



"NICE AND COOL is the way I keep the discharge water from jackets," said the operator. But that was hard on the fuel

NO STRAINER on air intake for diesel. Instead wire screen, tied over intake line, was badly plugged with grease and dirt

started. Chances for wrecking the compressor were excellent. Also, the liquid ammonia cut cylinder walls and piston as it removed lubricating oil from their wearing surfaces.

Superheating Suction Gas. Discharge line of each compressor was equipped with a high-pressure oil trap. Trap removed oil from discharge gas before it reached the condenser.

When installing the suction line from the storage rooms (which was after discharge piping had been erected), it was discovered that if suction pipe were run straight and direct to compressors, these high-pressure traps would interfere.

But this problem did not stop the "master builders"—they erected the suction line as originally planned, all right. But to do this, they had to place the line hard against the two 12-in.-diameter oil traps. Since that prevented insulating the suction line at these two points, temperature of discharge gas, depending upon suction pressure, often reached 225 to 270 F. So it wasn't difficult for me to explain some of the suction superheat. That high temperature in turn reduced compressor capacity and skyrocketed power bills.

What Price Liquid? Main liquid line supplying freezing-tank coils and two ice-storage rooms was $\frac{3}{4}$-in. diameter. Distance from liquid receiver to farthest storage-room coil was considerable, so actual, over-all length of liquid line was 107 ft. Besides, there were eight right-angle elbows in this line between receiver and evaporating coils in tank and storage rooms.

I learned that in making up this pipeline the pipes' ends had not been reamed to remove burrs after cutting to length with a wheel pipe cutter. Worse yet, litharge paste used on pipe threads had been applied to inside of fittings as well as to the threads. Paste on inside threads is shoved in by pipe end and hardens in one big lump. So combination of these two evils resulted in reducing net area of pipe and fittings. That, in turn, greatly reduced carrying capacity of a pipe, already too small.

Enough condensing water at 70 F was available and would normally have given a condensing pressure of 155 psi. But because of bad design and construction, it was necessary to reduce water delivered to condenser until condensing pressure could be maintained at 180 to 190 psi. Only at that pressure could sufficient liquid be forced through line to supply the evaporators. Combined effect of all this was that power costs increased, while plant capacity was reduced. That hookup was all wrong.

CASE NO. 2

This plant produced its own power with a diesel engine. But I discovered a number of things wrong because of ignorance, laziness and neglect.

1. No safety stops or alarm signals gave warning, or stopped engine if jacket cooling water or bearing lubricating oil failed, as often happens.

2. Jacket-water heat loss. While jacket cooling water was in closed system, water outlet temperatures from jackets were running at 100 to 108 F. This represented a heat waste to jacket water and lowered thermal efficiency. By increasing run-off temperature to 125-130 F, or higher, and reducing condensing-water circulations, I increased thermal efficiency. This was reflected in reduced fuel consumption per brake horsepower.

3. No air vents were installed on water outlet connections from jackets. Vents prevent water-circulating system from becoming airbound. Engine builder's instruction book clearly emphasized need of these vents but they were left out.

4. Makeshift filters. Air-intake system had no filters for removing airborne dirt and grit from the scavenging and combustion air. Instead, a section of screen wire had been fastened over end of intake pipe. Screen was badly clogged with grease and dirt, which prevented sufficient air for burning fuel to permit a normally clear exhaust from engine.

CORRECTION

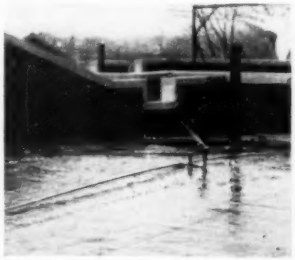
In Refrigeration Q & A, p 117, April POWER, sketch shows safety valves venting to atmosphere or to discharge header. This should be to suction header, which is the low side of system.

OPERATORS' NOTEBOOK 54

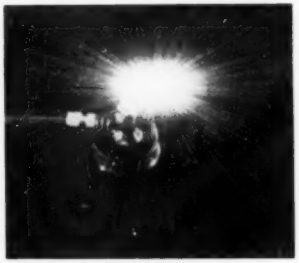
Cool Your Building Roof

TYPES OF SPRAYS IN ACTION

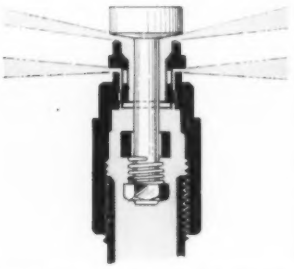
STATIONARY streams from jet *(below)* shower fine droplets. Roof thermostat controls water, keeps roof temp right



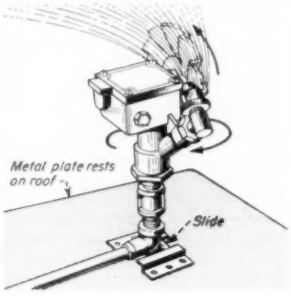
ROTARY cooler revolves slowly through gearing as wheel breaks up thin spray, uses no thermostat or electrical wiring



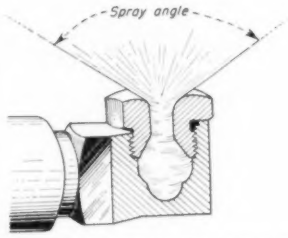
WHIRL JET throws fine sprays over roof, runs continually. Excess water, if any, runs into drain sump for recirculation



DOUBLE row spray head throws upper and lower streams. Upper sprays wide outer circle; lower inner area 10-ft diameter

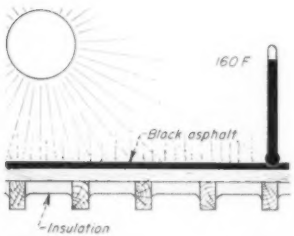


JET of fine spray is thrown over roof at 45 deg. Cooler runs continuously, revolves just enough to moisten roof

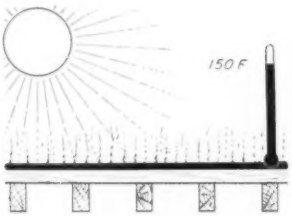


NOZZLE has no moving parts, but is designed so water whirls in jet, throwing hollow spray cone at very wide angle

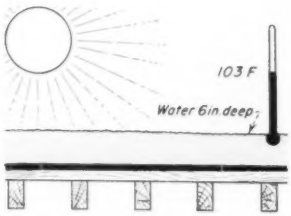
CONTROLLING ROOF TEMPERATURE



INSULATED roof's temperature gets high as 160 F on hot day because heat can't get in. Roof deteriorates fast



UNINSULATED roof of same construction reached 150 F on same day. The spaces under this roof are hot, need cooling

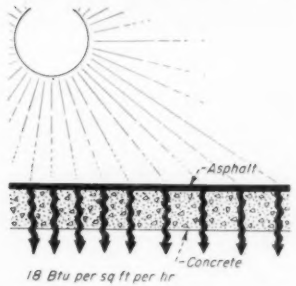


FLOODED roof is cooler, but water stores heat, gets stagnant, mosquitoes breed—so must be treated. Roof may also leak

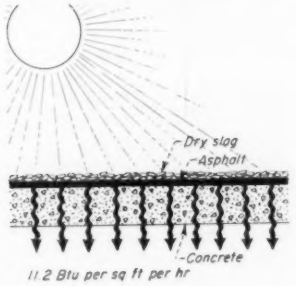
By Making It Sweat

By **STEVE ELONKA**, *Associate Editor*

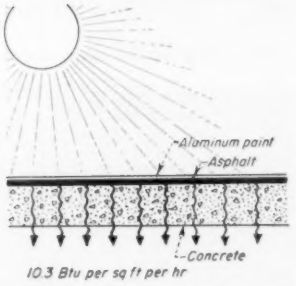
THIS MUCH HEAT GOES IN



ASPHALT over concrete let in 18 Btu one hot day in August. Black roof absorbs most heat from hot rays of sun

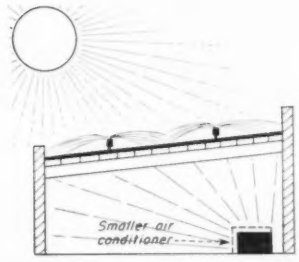


DRY SLAG over asphalt of same concrete roof on same day absorbed 11.2 Btu. This is less heat, but too much for comfort

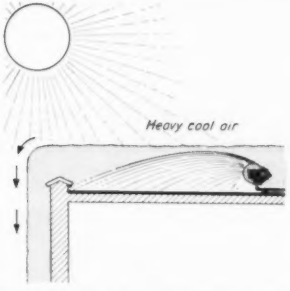


ALUMINUM paint over asphalt of same concrete roof on same day let in 10.3 Btu because light color reflects rays

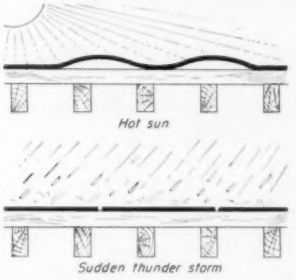
ADVANTAGES OF SPRAYED ROOF



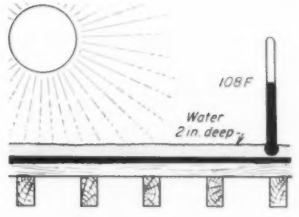
LESS air conditioning for top floor by 20%. Top floor cooler than floors below, smaller power bills, less upkeep



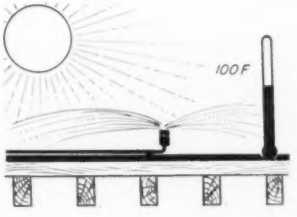
WALLS are cooler because heavy roof air spills down along walls, cooling them, so help make inside spaces comfortable



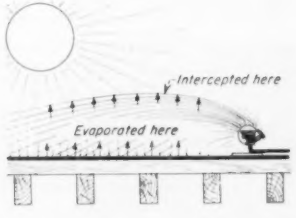
SAVES ROOF as volatile oils vaporize less. There's no thermal shock from sudden thunder storms because roof is cool



LESS WATER raises temperature slightly. But 108-F water blanket won't draw heat up through roof as will sweating roof



SPRAYED roof is cooler—spaces below are about 85 F—water evaporates fast as it hits roof, pulling heat from inside



SPRAYED roof cools in two ways. Water droplets intercept heat before hitting roof; roof film evaporates, pulling heat

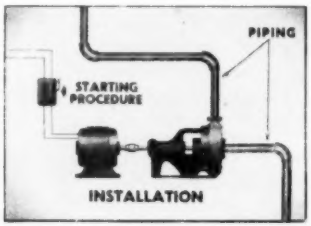
★★★★ FILM PREVIEW

Don't miss this! Sure-fire tips on pump maintenance. It isn't at your local movie but it's AAAA in our book. We think it will be in yours, too. We show less than half of this talkie; engineering groups or your plant can get the entire show from Allis-Chalmers

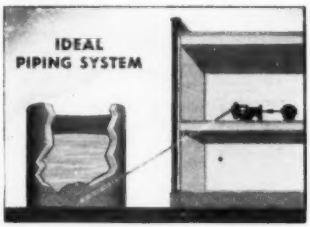
By **JOHN GAMMELL**, *Supervisor of Sales Training, Allis-Chalmers Manufacturing Co*

1 Our hero, Elmer McGant, maintenance boss, learns of pump care in hurry

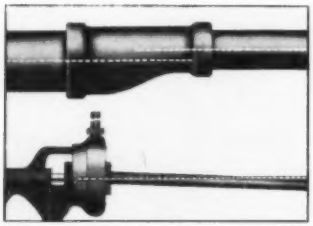
5 Says Tom: I learned the hard way like not opening running-pump prime cock



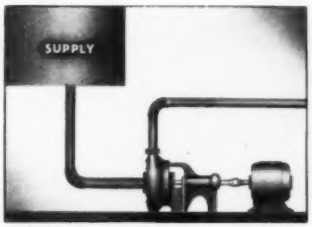
6 And setting up a pump is easy if you install, pipe and start it correctly



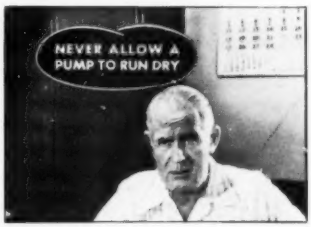
7 Your ideal suction pipe is straight between pump and source of supply



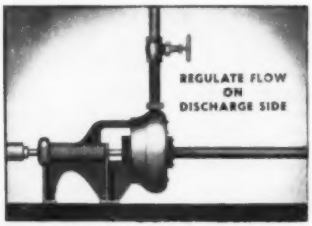
11 Use eccentric reducers, and slope suction pipe down, away from pump



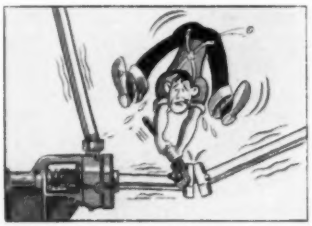
12 Don't worry about losing prime if supply is above pump as shown here



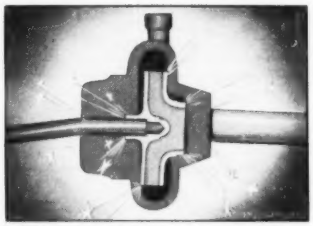
13 Just remember: Never allow a pump to run dry—or even partly dry



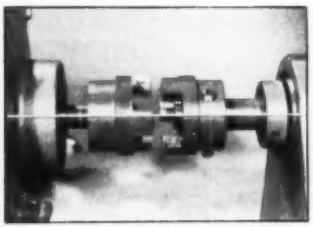
17 Regulate flow on discharge side so there's no chance to cut suction



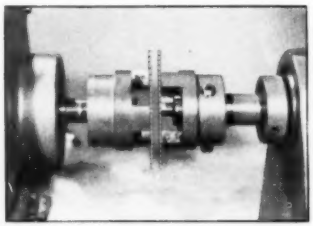
18 Be sure pump and pipe flanges line up. Never force your pipe joints



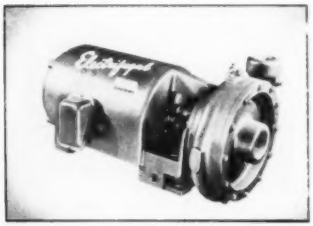
19 Strain reaches pump, may spring the casing. Closely fitted parts wear



23 With shafts lined up right there's little wear in the motor and pump



24 See that pump and motor flanges are same distance apart at all points

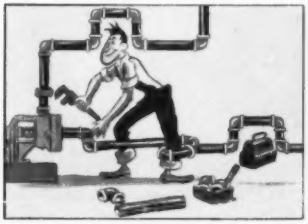


25 You won't have alignment trouble with well-built close-coupled unit

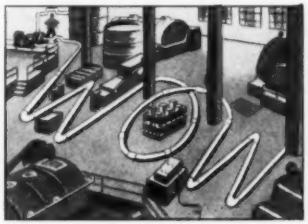
2 Today is one of those days. Everyone in the plant yells for Elmer McGant

3 Elmer forgets that pumps, set up OK, given good care, stay out of his hair

4 So let's ask Tom Jones, maintenance boss too, how Elmer can stop trouble

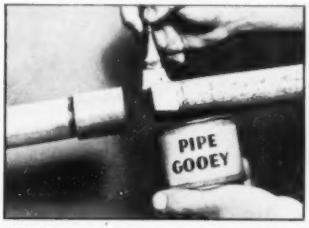


8 But you and I know piping jobs aren't easy. Never run this way; think first

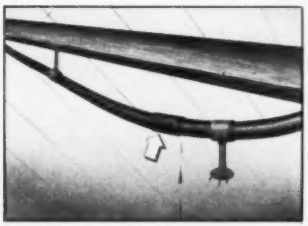


9 Or you'll wind up with a wow of a layout the pump will hate you for

10 Easiest way to pipe is to keep the layout simple with very few bends

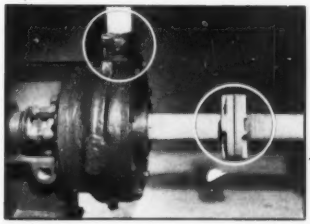


14 Keep air out of suction by using a good pipe compound on each joint



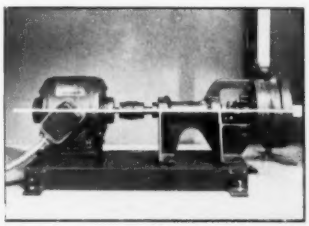
15 Even joints that are tight to start with may leak if pipe sags like this

16 Use a foot valve with strainer on it and you're sure pump is primed

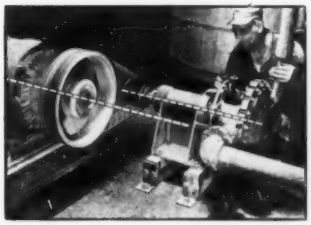


20 Have pipes and pump lined up right before you make a pipe connection

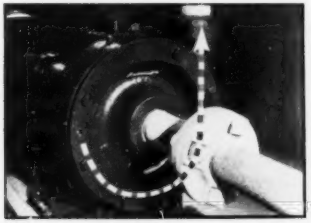
21 Support pipes firmly. Watch for building settling, loose supports



22 Now when you install the pump be certain it is lined up correctly



26 You don't have to be so fussy about alignment of sheaves for belt drive

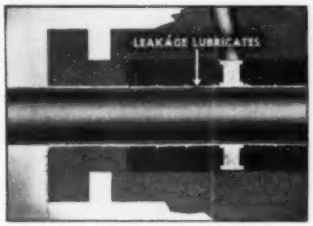


27 Be sure pump runs in right direction. Backward operation cuts flow

28 Dry packing burns up fast. It may score shaft sleeve, leak too much

More on next page

SEE THIS FILM NOW! IT'S A FINE REVIEW FOR OLD-TIMERS, A GOOD BEGINNER COURSE . . .

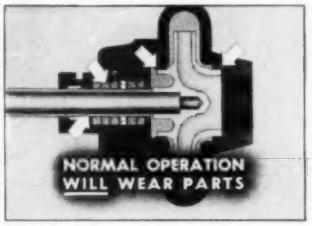


29 Some packing is lubricated by small amount of liquid that leaks past it

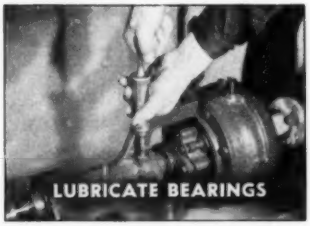
30 But leakage of liquid containing an abrasive may ruin the pump sleeve

31 Connect clear liquid supply to stuffing box to stop abrasive wearing

35 Keep a file card for each pump. On it record all maintenance work done

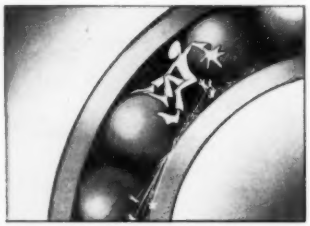


36 Normal running wears some parts of pump. That's why you must inspect

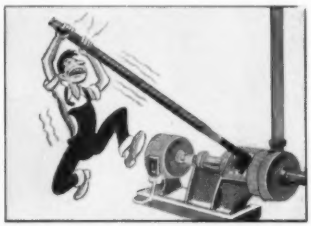


37 Lubricate bearings with right oil or grease as part of maintenance

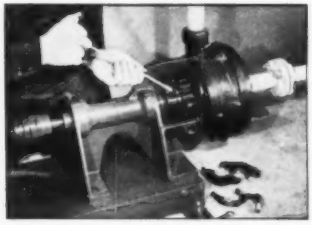
41 But be wary of grease. Too much gives as much trouble as too little



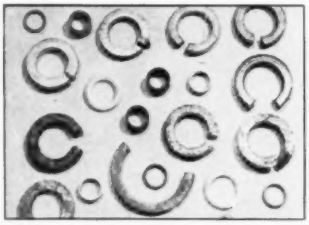
42 Too much causes friction in an antifriction bearing; race may score



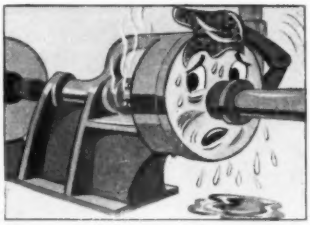
43 If gland leakage won't stop after *regular* tightening, replace packing



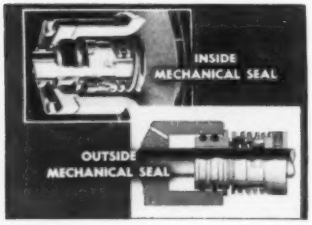
47 Use packing tool to take out all old packing. Clean inside of box



48 Be sure to use right packing to replace old. There are many types

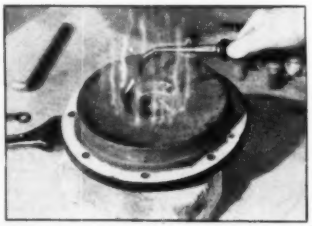


49 On some pumps, stuffing box runs hot because of job, pump location



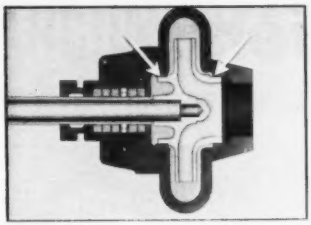
53 There are two types—inside and outside. See pump maker for best uses

54 Replace wearing rings when pump won't deliver its rated capacity



55 Heat casing around ring with torch so metal around ring expands or . .

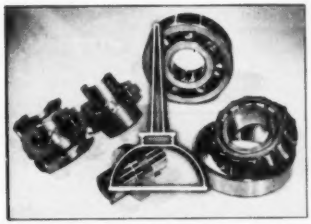
...IT WILL MAKE YOU THINK. THERE'S PLENTY TO BE LEARNED BY ALL PLANT OPERATORS



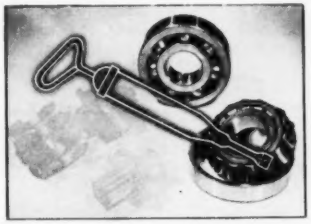
32 Inside casing, liquid being pumped acts as the wearing-ring lubricant

33 Never run a pump dry! Fill entire suction system with liquid. Check

34 Watch gland for leakage. If too much liquid comes out, tighten nuts

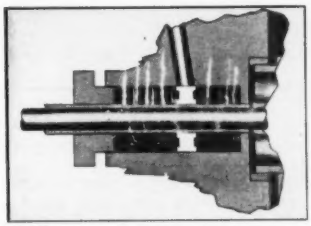


38 Always use oil on sleeve bearings and on some ball and roller bearings

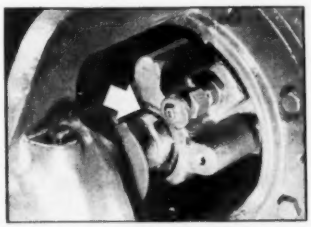


39 But many ball and roller bearings need grease. Check with maker

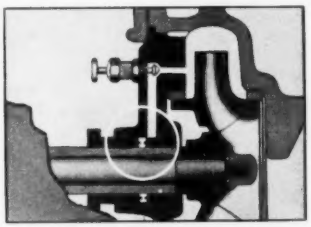
40 With sleeve bearings use enough oil of right kind. Change it regularly



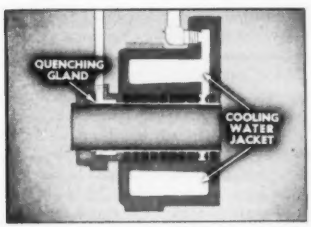
44 Tight packing can give too much friction and heat, score the shaft



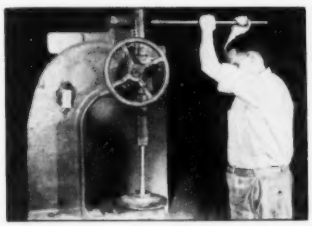
45 To renew packing, A: remove gland. B: then before you do anything . . .



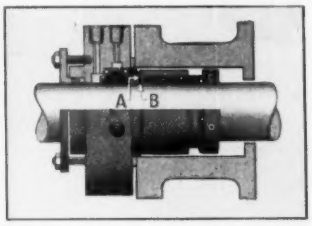
46 Check position of the seal cage. If it isn't right, shaft may score



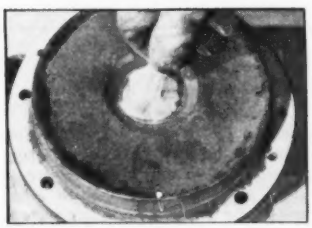
50 If you have this trouble, install quenching gland or cooling jacket



51 When packing renewal doesn't stop leaks, press off the old sleeve



52 Instead of resleeving, repacking, you can use this mechanical seal



56 Shrink wearing ring by packing it with dry ice. Either method is OK

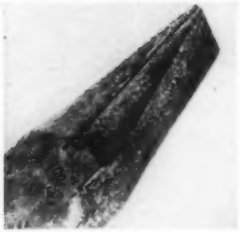
57 While pump is torn down clean the impeller. This steps up efficiency

58 Now Elmer McGant is out of dumps; he uses these tips on his pumps

Film produced by Atlas Film Corp

New Life for Pliers...

. . . as prescribed by the Utica Drop Forge and Tool Corp



HEAVY RUSTING

Rust-tightened joints call for kerosene soaking. Allow from a couple of hours to a few days, depending on extent of rust. After it is loosened, remove with putty knife, steel wool. Use a few drops of penetrating oil to free joint. Open, close pliers to work all rust loose from concealed joint parts. Prevent rust by occasionally wiping pliers with oily rag. Avoid unnecessary weather exposure.

BROKEN NOSES

Grind off even. Hand or electric bench grinder does a good job. Keep temperature of tool down by pressing lightly against wheel and dipping in water often. If plier-nose tips don't touch properly, slip a 1/16-in. wedge about midway in their length. Hold on a firm base and tap *gently* with hammer about ½ in. from tip. Go through same steps to line up other side of the pliers.

LOOSE RIVETS

You'll need a ball-peen hammer and a steel block. Note plier rivet has solid and broached side; solid side is perfect circle. For *loose* rivets, place broached side of pliers on steel surface and tap top half of rivet with flat side of hammer. For *tight* rivets, place broached area over hole in steel block. Hit rivet with flat side of hammer. For *jumpy* rivets, tap broached side with round end of hammer, pliers open to jump point. Jumping usually caused by loose broach.

DULL CUTTING EDGE

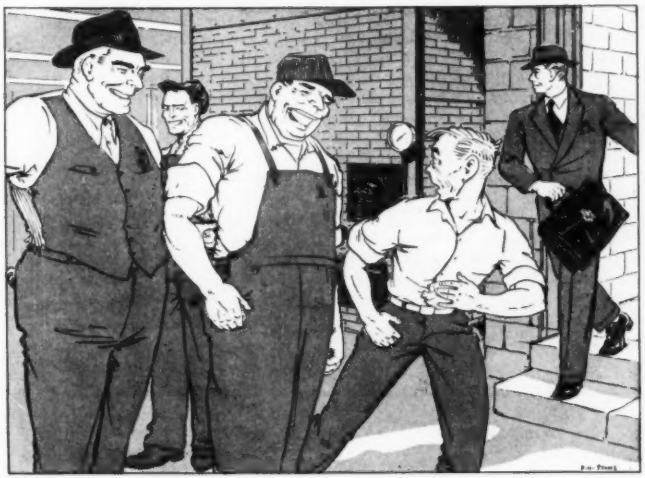
Spot nicks in cutting edges by holding closed pliers to light. Place open pliers in vise and run medium-fine, oiled India stone across each edge in turn. Triangular stone works best. When edges meet along entire length in the light test, you're ready for sharpening. To sharpen, place in vise, and stone outside bevel of each edge. Hold to original cutting angle. Generally only outside bevel needs sharpening. Hold pliers to light for final check on edge.

WEAK CROSS-CHECKING

Here the trouble shows up when you just can't grip wire or fine objects. Cure is in stroking a "checking" file across pliers' noses, matching existing check. Another way out: Use triangular file such as is used for sharpening saws. Once again, follow tracks of old check marks. Use just enough pressure to sharpen check. Deep grooves aren't needed for good plier-gripping surface.

ARGUMENTS

Here's the place to unload your gripes to editors, manufacturers and fellow engineers



THE OLD RAZZMATAZZ

I DROPPED INTO a shoe factory awhile back to see if I could drum up some business. I sell boiler equipment, so the first place I headed for was, of course, the boiler room. I was just reaching for the door handle when someone inside yelled, "There she goes." The usual factory noise was shattered by a resounding CRUMP, followed immediately by an ugly WHOOM and the sound of tinkling. All came from inside the boiler room.

The door swung open by itself, propelled by a cushion of hot air, and I stepped inside. The scene wasn't what I expected. The chief fireman and several of his cronies were standing around red with laughter, while an obviously new helper was looking scared as a fresh-flushed jack rabbit.

Sure enough, the boys were giving the greenhorn the old razzmatazz . . . lighting the oil burners off the hot brick. Hopping mad, I cornered the fireman and impressed on him the rule of purging the firebox before lighting oil, gas or pulverized coal, and then lighting off with a torch of some kind. I also told him that the vibration of lighting off the bricks could ruin his brickwork and damage the piping.

Just then I remembered the tinkling noise I'd heard just after the explosion. So, taking the old boy firmly by the arm, I walked over and opened the firebox door. There, nicely scattered over the floor of the furnace, was the most useless pile of broken firebrick I'd ever seen. That convinced him. He swore off his pranks for good, and I got a big, fat order for Handy-Dandy firebricks.

STEVE SMITH *Canton, Mass.*

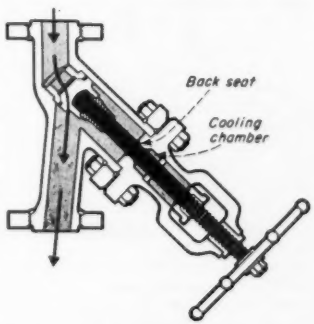
Way Back When . . .

. . . I WAS WORKING as an apprentice at the Vulcan Iron Works in San Francisco, in 1906, I noticed the shop foreman, a Swede named Thompson, looking over the men and boys in the shop. He'd stop and look one over from the rear then lay a 2-foot rule across his shoulders. It turned out he was trying to find someone narrow enough to enter a small tank. I wasn't the one this time, but another time I was.

The iron works faced on a dead-end street that ended in a bluff. There was no traffic on it, it had never been paved, and we used it as a work yard. One day I was ordered to paint the inside of a tank 30-in. in diameter and 6-ft deep. It had a bottom but was open at the top.

I laid the tank on its side and, as there was a slope to the road, put blocks under it to keep it from rolling. Then I got a can of red paint and brush, crawled inside and started painting. Some other apprentice boys saw a chance for some fun, so they took out the blocks from under the tank and set it rolling down the hill with me and the can of paint inside. Believe me, I saw red, and plenty of it . . . for days.

H T LIVINGSTON *Los Angeles, Calif.*



X Ray in Order

H A JAHNKE (p 125, *March* POWER) should have had his head X-rayed for loose bolts and nuts. Never enter a boiler or any pressure vessel unless all connecting lines are marked with hold tags, or blanked off completely. Never go in while the water is turned on!

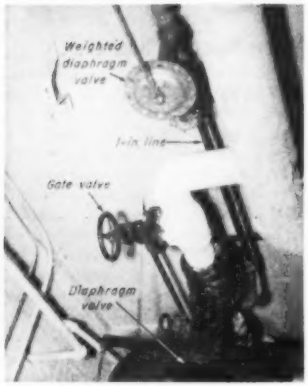
As for tools, get in drum first, then have helper hand tools in after you. Put tools in a bucket, so they won't drop into tubes. And count them after you get out. Best method of getting in is to put one leg in first, then get your head and shoulders in.

B D RILEY *Brunswick, Ga.*

CORRECTION

IN OPERATORS' NOTEBOOK No. 52 (April, pp 108, 109) the straightway-flow blowoff valve shown above was erroneously listed as being "good to 600 psi." Actually, it is rated for pressures up to and including 2500 psi. And, of course, the straightway-flow principle may be applied at any pressure.

PRACTICAL IDEAS...*here's the trading post for your*



BYPASS LINE SOLVES STEAM PROBLEM

OUR HOSIERY MILL has three preboarding machines that take 15 cu ft of steam every 10 min. It's taken in one big gulp, and nary a nickel's worth of condensate comes back to the boilers. It's so full of wax sizing that no respectable boiler could digest it.

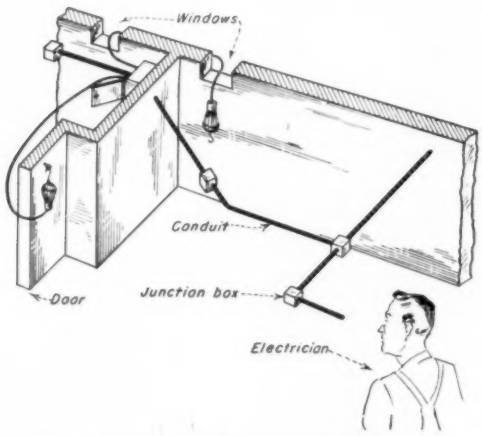
These preboarding machines kept robbing our building of heat, so I had to do something. A 3-in. line runs from boiler to heating system. Process takes boiler pressure of 25 psi, but heating system takes only 4 psi. Steam is reduced to 4 psi by a diaphragm valve, controlled by a regulator, photo.

Every time the regulator called for heat while preboarding machines used steam, the boiler was robbed of steam. When I took over plant they tried to regulate steam flow by closing 3-in. gate valves before diaphragm valve.

I placed a 1-in. bypass line around the diaphragm valve. It has a weighted-type valve, set at 4 psi. This line keeps 4-psi steam in the heating system, even when the preboarding machines are drawing heavily on the boilers.

This hookup works fine. Boiler is not robbed of steam by the 3-in. line and heating system gets enough steam between peak loads.

L HACKETT *Irvington, N. J.*



LONG-WIRED TEST LAMPS

DROPLIGHT, used as a test lamp, does away with a second person at the fuse board to shout if short or ground has been cleared. Make it 12 ft or more as long droplight is handy if you're some distance on other side of partition.

Make up two test lamps as follows:

1. For cartridge or knife-type fuses, install two alligator-type clips onto end of wires. Slip soft-rubber insulating sleeves over them.

2. For plug-type fuses, install a burned-out plug fuse by soldering it onto the end of the wires. Then insulate it with rubber and tape. A standard male and female plug combination will do.

When testing for a short or ground, remove the fuse in the line. In its place install the test lamp. Let it out on the long wire and hang the bulb's cage by its hook in a position easily seen when it goes off. Then you won't have to leave the place you must work to trace the trouble. This idea saves many footsteps and time. It also eliminates getting the wrong information from a helper at the fuse board which delays the job.

F LETTINO *Astoria, N. Y.*

Stoker Repairs

A $\frac{3}{4}$-IN. BOLT, 4 in. long, was wedged in between the feed screw and the coal-delivery pipe. It was impossible to remove the bolt by reversing the feed screw or by prying it loose with a bar. I removed it with a cutting torch.

Of course, I had to be careful not to injure the feed screw while doing the cutting. At times it is possible to remove an obstruction in this screw by reversing its rotation. Then you have to change the wires at the motor switch. If motor is the 3-phase 60-cycle type, use a double-throw switch. Don't run screw in reverse too long or it will work out of its socket. Then you will have trouble getting it in place again.

Some underfeed stokers are in a pit at the boiler's front. Removing a worn or broken feed screw isn't easy. I remove the transmission, hopper and base to get the screw out. I also have to remove coal-delivery pipe between hopper, base and retort, and also part of front windbox setting.

Much time can be wasted in removing and replacing this equipment. Especially if stoker pit is near a boiler-room wall or next to an alley.

To reduce time and labor, I cut a hole in the wall, also under the alley. After this, when replacing a new screw, remove transmission, hopper and base. Then pull old screw out of retort and coal-delivery pipe into the boiler wall and alley hole, until it clears delivery pipe. This method saves labor.

H A JAHNKE *Milwaukee, Wis.*

operating and maintenance short cuts

STEVE ELONKA, *Associate Editor*

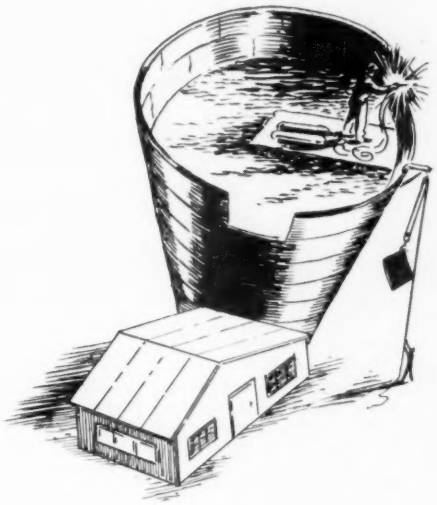
WREck TANK THE EASY WAY

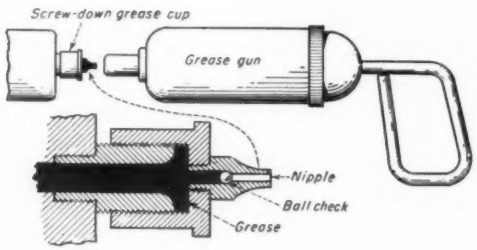
TEARING DOWN a steel water tank, 40 ft high, looked like a tough job until one of our boys suggested doing the job from the inside. It was just a case of building a small raft and working our way down as we lowered the water level. In this way no scaffolding was built either inside or out. And we were always on a level with our work.

The steel plate was cut away in sections with gas torches. Then they were lowered to the ground with block and tackle.

With a few obvious precautions, this method can be used in many places.

GEORGE GRIFFEL *Bronx, N.Y.*





GREASE CUPS FILLED UNDER PRESSURE

THE COMMON screw-down grease cup is an efficient lubricator if filling is not overlooked. One filling usually lasts for a long period. But lapse of time between fillings encourages neglect. Greasing and oiling machines regularly is more likely to be remembered if it's a task at start of each working day. A daily routine is performed automatically, but a monthly routine is apt to be neglected.

Now, topping up of screw-down lubricators with grease is daily routine in our plant. We fit each grease cup with a grease-gun nipple. Top surface of screw-down cap is drilled and tapped to take a standard nipple. Every day, maintenance crew makes the rounds of all grease cups and injects the grease into the cups under high pressure. Then reserve supply of grease is always present in cups in case bearings run hot.

Grease cups are now always full. Furthermore, filling them from an open can risks dirt and grit mixing with the grease. There's no need to unscrew lubricator cap since using the grease gun maintains a constant high pressure of grease within the cups.

This system has cut down hot bearings in our plant almost to zero.

F E RILEY *London, England*

Cold-Starting Diesel

I HAVE TO START a number of large and small diesel units in Minnesota, with temperatures below zero at times. Here are a few pointers: (1) Maintain good compression by periodic checks of rings and valves. (2) Use lube oil with a good cold test and keep free from moisture and condensation. (3) Change to a higher and better grade of fuel in winter. This not only helps in starting but also gives much better performance during lower ambient temperatures. (4) If possible, heat jacket water by auxiliary means. (5) If you still have trouble, try this: Mix 20 parts potassium nitrate, 1 part lead acetate, 79 parts water.

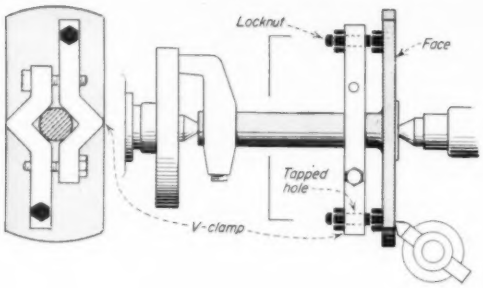
In this mixture, saturate a piece of heavy blotting paper, about 1½ in. wide and 4 in. long. After it's well saturated, remove and let dry thoroughly. Then enclose paper in an airtight bottle. If you can't start engine, remove fuel nozzle and insert one piece of treated paper in cylinder proper. Then replace the nozzle. On multiple-cylinder engines, insert in three or four cylinders.

As engine turns over by air or starter, compression in cylinder causes paper to glow and furnish flame ignition. That ignites fuel faster and starts engine.

H GREINER *Anoka, Minn.*

(*Continued on page* 128)

Begins on page 126



SUPPORTING THIN LATHE WORK

We had a large machine part with a thin flange on a large-diameter shaft. Shaft was too large to slide into hollow lathe spindle so it was turned between lathe centers. When taking a facing cut across the flange end, we found the tough material caused face to spring away from cutting tool.

We made a support from a common V-clamp of the bent-bar type, sketch. By drilling and tapping through the arm ends, a bolt was screwed in each end. Clamp was locked to shaft portion of work and screw heads were set to make contact with back of flange to be machined. Bolts were locked in position with a locknut on each screw. Bolt heads and V-clamp prevented face from deflecting under cutting-tool pressure.

F E Riley *London, England*

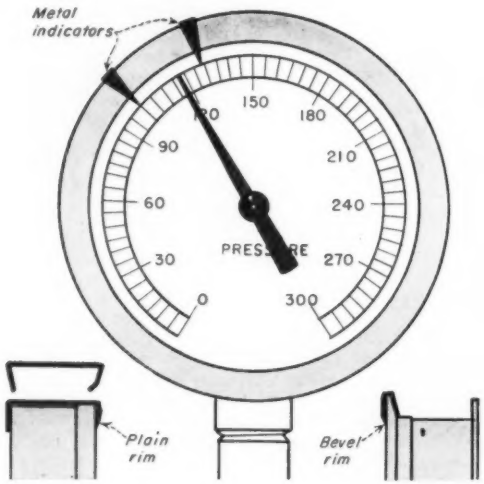
Priming Cracks Bearings

Babbitt liners in bearings of a 4-cylinder 4-stroke-cycle air-injection diesel engine gave trouble. Babbitt cracked in the top halves of the bottom-end connecting-rod bearings of No. 3 and 4 cylinders. But on cylinders No. 1 and 2 the babbitt showed no cracks. These cylinders had the air-starting valves.

We rebabbitted the defective bearings, being careful to get a good fit, so play in the bearing would not again cause trouble. About six months later when the bearings were inspected the same ones were cracked. These bearings were overloaded from some cause.

When the engine was again ready for service we had each operator start it. Two of them heavily primed the fuel pump while the engine turned over on air. Indicator cards taken under these conditions showed that heavy explosions occurred in cylinders No. 3 and 4, causing pressures up to nearly 800 psi compared to a normal maximum of 500 psi. Careful instructions on proper starting stopped the heavy firing when starting. No more bearing linings cracked.

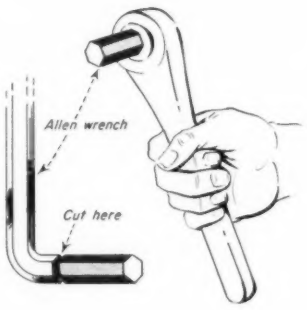
J R Williams *Columbus, Ohio*



HANDY METAL GAGE INDICATOR

By clipping two small pieces of spring metal, formed as shown, to the cover-glass frame of an ordinary gage, the minimum and maximum reading limits can be determined at a glance. This eliminates the need for closely checking the actual reading on gages.

T Trail *Catonsville, Md.*



Allen Ratchet Wrench

Manufacturers are resorting more and more to setscrews and bolts of the Allen or hollow type. Often the screw is used in tight corners, where a hex head would be impractical. Many times it's even difficult or laborious to swing the Allen wrench. In our plant we cut a piece off the wrench and then use a standard hex or star socket in ratchet wrench, as in sketch. This wrench is handy.

F J Ardolino *Brooklyn, N. Y.*

(*Continued on page 130*)

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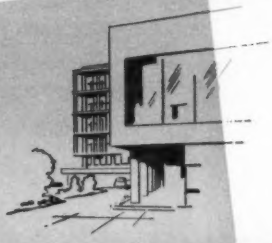
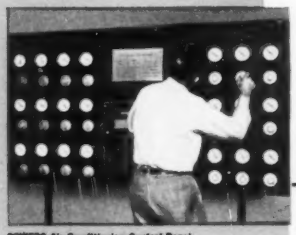


Typical Clerical Space



POWERS Air Conditioning Control Panel

POWERS air conditioning control

Helps Insure Maximum Comfort and Efficiency in

Famous PAN AMERICAN LIFE INSURANCE CO. Building
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In this unique louvered structure comfortable temperature and humidity conditions are assured regardless of the weather outdoors.

Employees are more efficient and alert, make fewer mistakes and turn out a better day's work in properly air conditioned work spaces.

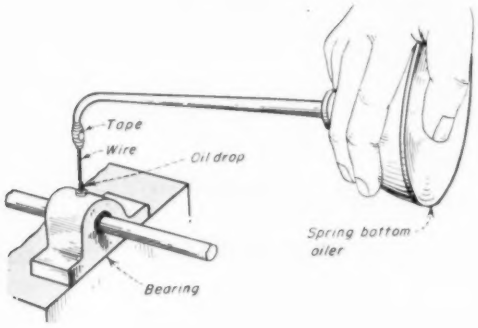
Prominent insurance companies from coast to coast have found the year after year accuracy of dependability of Powers equipment a very profitable investment.

When problems of temperature and humidity control arise, contact Powers' nearest office. Our more than 60 years of experience gained in all types of prominent buildings may be helpful to you.

THE POWERS REGULATOR CO., SKOKIE, ILLINOIS
OFFICES IN OVER 50 CITIES
SEE YOUR PHONE BOOK

(a82)

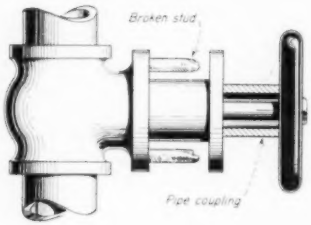
Begins on page 126



OILER FOR SMALL BEARINGS

EVER TRY TO oil small bearings when small oiler was not handy? Just use a regular-size spring-bottom oiler as shown. Insert a length of wire in the oiler spout. Tape wire to the spout's end. When the oiler is tilted, oil passes along the wire and drops off its end in small drops. This trick oiler has come in handy plenty of times.

T TRAIL *Catonsville, Md.*

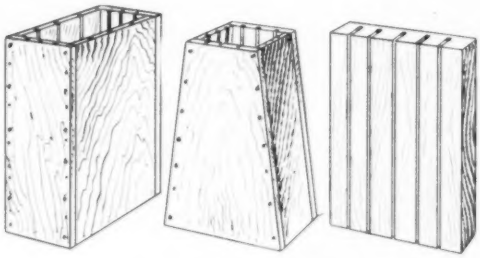


Packing-Gland Trouble

VALVE STEM on a 3-in. water line gate-valve started to leak badly. I had to tighten the packing gland, but its studs were rusted so badly they twisted off when I screwed down on the nuts.

I removed the wheel and the packing gland from the valve stem. Then I added more packing to the stuffing box and replaced the gland. I placed a 1-in. pipe coupling over the valve stem, sketch, and replaced the valve wheel. In this way, when closing the valve, the valve wheel and coupling forced the packing gland against packing into the stuffing box. That held them there until there was time to renew the studs. This valve was usually closed, so that helped until new one arrived.

H A JAHNKE *Milwaukee, Wis.*

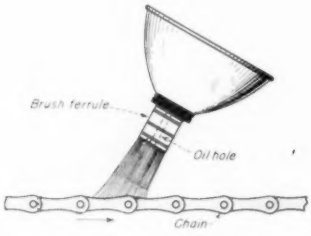


FOUNDATION CORES

IN PREPARING FOUNDATION for large diesel engines, we used to make small wooden boxes for leaving bolt holes in concrete. These boxes had to be removed before the foundation bolts were inserted. But with large engines and long bolt holes, it was a hard job to break up these boxes. Reason was the wood would swell from moisture in cement. Then it would force itself tightly against the surrounding concrete.

We tried to find an easier method. Erecting a diesel engine of 1500 hp in the powerhouse at Paramaribo, I solved this problem as shown in sketch. Just make slots in wood with a circular saw. It's very simple, but I can assure you it works fine, even with tapered forms. It's easy to collapse the wood with a pinch bar against the concrete.

D WIJSMAN *Paramaribo, Dutch Guiana*



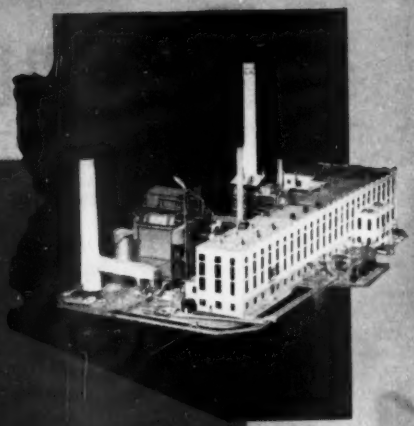
Safe Chain Oiler

"NEVER LUBRICATE a chain drive by hand while it's in operation" was one piece of advice I never forgot. That was after I saw a bad accident.

A simple chain hand oiler may be made from an ordinary spring-bottom oil can and a paint brush, as shown. Unscrew the oil-can spout and remove the long spout from its coupling. In its place, solder the metal ferrule of the brush to the coupling. Then drill an oil passage through the cement and bristles.

T TRAIL *Catonsville, Md.*

ALSO IN ARIZONA, IT'S YARWAY



PUBLIC SERVICE

PICKS

YARWAY UNIT TANDEMS

FOR 920 PSI SLOW-DOWN SERVICE

Arizona Public Service Company—operating in the youngest, but one of our fastest-growing states—is another prominent utility that relies on Yarway Unit Tandem Blow-Off Valves to guard its boilers. In fact, *4 out of every 5 high pressure boiler-plants are Yarway-equipped.*

Such popularity had to be won. It was—by offering good design, careful engineering and manufacturing, modern metallurgy and dependable service.

Yarway engineers, conveniently located near you, are constantly working for better, more profitable steam plant operation. Need help? Call a Yarway man.

TARBELL-WARING CO.
100 Mermaid Ave., Phila. 18, Pa.
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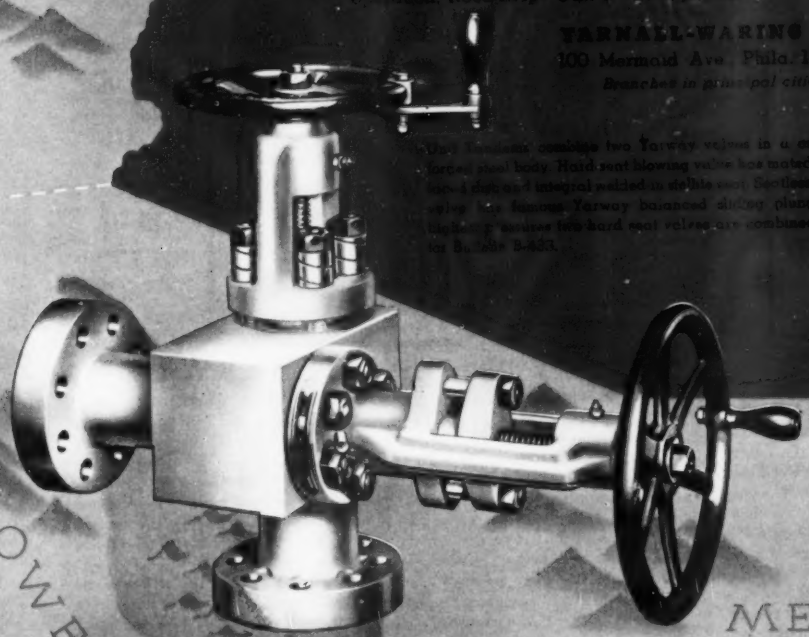
One Tandem combines two Yarway valves in a one-piece forged steel body. Hard seat blowing valve has mated stellite-faced disc and integral welded-in stellite seat. Seatless sealing valve has famous Yarway balanced sliding plunger. For high pressure service two hard seat valves are combined. Write for Bulletin B-453.



YARWAY SERVICE GOES ALL THE WAY....

PLANT PROBLEMS... *put your know-how to work*

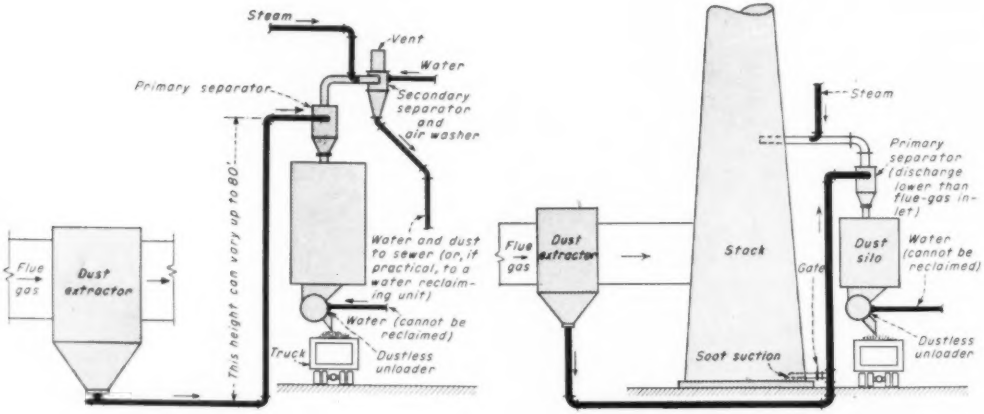
How Can We Move Our Flyash to Dump?

HERE ARE THE FACTS: Recently we installed a dust extractor in our 14,000-kw steam plant. Fuel is low-grade lignite with about 30% ash. It is fired by pulverizers.

At present we move dust from extractor to our dump by hand truck. When there's a wind the dust is blown out of trucks, causing a great nuisance around the plant. One of our engineers suggests putting in a pneumatic conveyor to move dust from extractor to dump. Water sprays in dump will wet down dust and keep it in one spot.

The one catch is that water is scarce in our plant. Is there any other way of handling this dust? What's best way of handling up to 50 tons of dust per day without wasting water? Can the used water be reclaimed?—*RW*, March *Power*

Here Are the Answers



MAIN PURPOSE of a dust extractor is to keep dust and flyash out of air around plant. Transportation by hand truck and outdoor storage makes the money you put into extractor almost worthless. In other words, *RW*'s money is being blown away.

I can figure only two angles on *RW*'s job: either enough money wasn't on hand to finish job or it was poorly planned.

Sketch at left shows a good system. Primary separator is 85% efficient. Air washer and secondary separator remove carryover from primary unit. Completely dry dust is handled in dust-tight bin. Dustless unloader of rotary-drum type has adjustable water nozzles that dampen dust as it is loaded to truck or railroad car.

Sketch at right is compromise, having least equipment needed to give dust-free handling. Have primary-separator discharge lower than flue-gas inlet so dust settles better. About 60 gal of water per ton of dust is needed by unloader. Water can't be reclaimed. Since water doesn't have to be pure *RW* can use waste from almost any plant process.

G F CONNELL *Detroit, Mich.*

"How Can We Keep Air Heater Clean?" *Can you help our reader who sent in this problem? Details on p 136*—ED.

BLOWOFF-TANK discharge is good for wetting ashes if there's enough of it and temperature is low enough. I think *RW* would be smart to look this source over before using clean water.

HARRY CONGDON *Auburn, Mass.*

COLLECT AND SELL ASH. We sell all ash and flyash to a building firm making underground pressure pipe and building blocks. We're paid for all forms of ash. Building firm also pays transportation.

ARTHUR BELTON *Montreal, Que.*

HYDRAULIC ASH-REMOVAL system costs less than pneumatic system if both have a dewatering tank at dump. In either case *RW* will have to lose some water. He can reclaim most of it with a settling tank.

C W PARKER *Montreal, Que.*

NARROW GAGE TRACKS and small coal-type scoop car with built-in turntable is most economical solution. Build hinged removable cover for car to keep down dust. Track is simple to handle and move to a new location when ash pile builds up. Car may also be used for other materials-handling jobs around the plant.

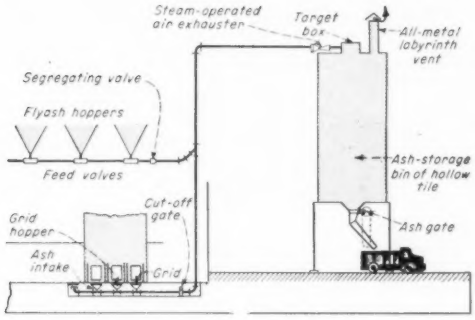
To recover water *RW* will have to build concrete settling pits. As ash settles to bottom about 95% of water can be recovered. Accumulated ash must be removed when pit is full.

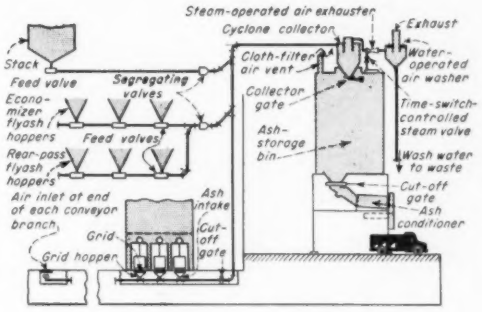
Large utilities figure 70¢ per ton for handling their flyash in the plant.

L W FITZPATRICK *Jefferson City, Mo.*

help the other guy cure his headaches

TYLER HICKS, *Associate Editor*

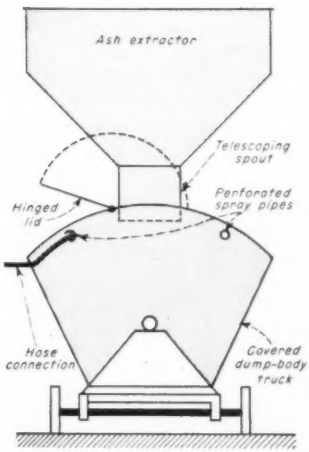




STEAM-OPERATED air exhauster will discharge ashes to bin. See sketches. Connect exhauster inlet to extractor outlet. Have ash-storage bin high enough to allow a truck to drive under for collection.

Fit water spray to bin outlet to help keep dust down. You won't use enough water to make reclaiming it worthwhile.

B D RILEY *Brunswick, Ga.*



CONCRETE PIT under extractor can be built to collect flyash. Flood pit with water when full of ash. Then dig out wet ash and move to dump. This is a tough job but solves problem at low cost.

If *RW* has dump trucks that fit under extractor outlet, he can use them as in sketch. Design spout and hinged lid so there's a dustproof joint between the two when truck is being filled. Fit spray pipe to wet the ash as it enters truck body. Waste water from drinking fountains, washrooms, boiler blowdown, floor drains and roof gutters is fine for wetting down ashes.

Pneumatic conveyor will move ash to dump if it isn't too far from plant, but outlet end will have to be shifted as ash builds up in dump. Also, pneumatic system may take more water.

H T LIVINGSTON *Los Angeles*

PNEUMATIC CONVEYING between plant and outdoor storage silo is best. Silo discharges to electrically driven mixer conveyor fitted with water sprays. Conveyor discharge is transported by open truck to dump area. We use this scheme in our plant and have no trouble with dust being blown around by wind.

A M PALMER *Brooklyn, N. Y.*

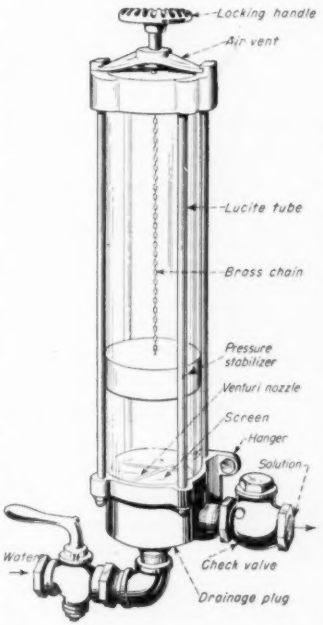
RUN SEWER PIPE, vitrified type, from extractor to dump. Use air to convey ash through pipe. Fit cyclone to dump end of pipe. If ash weighs about 20 lb per cu ft and has no clinkers a conveying velocity of 3000 fpm is good. Steel pipe supported above the ground may be used in place of underground pipe.

Contact fan manufacturer for his recommendation on size and type of fan. Send him a sketch of piping layout and a sample of ash to be handled.

Feed ash through fan, screw or venturi feeder. If fed through fan, special abrasion-resistant wheel and casing will probably be needed. Only water needed is that for a light sprinkling of ash as it leaves cyclone separator.

IRA A BUTCHER *Cincinnati, Ohio*

"How Can I Stop Ceiling Condensation?" *Turn to p 136 where our reader sets down his headache for you to cure.*—ED.



WET FLYASH with "wet water." This is ordinary water mixed with a wetting compound. One type of wetting agent goes into solution at a constant rate. By hanging a piece in blender shown in sketch, *RW* can easily wet down his flyash with a hose or a header of pipe.

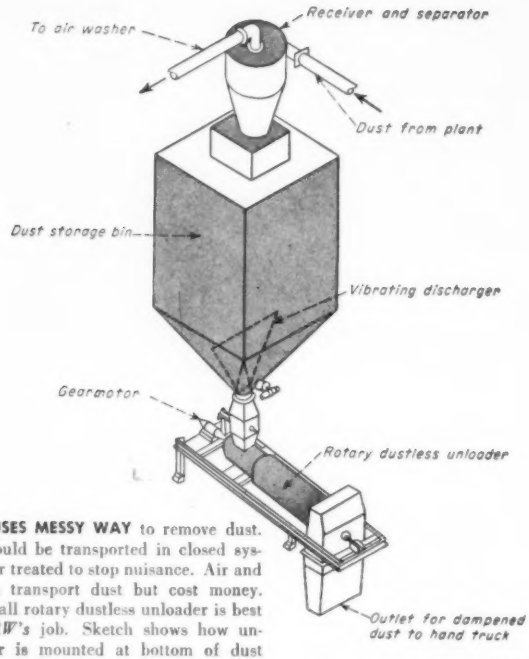
This scheme is excellent for him because water quantity is reduced more than 50% and haulage costs are less than when only water is used for job.

C F DELAMATER
West Hartford, Conn.

(*Continued on page* 134)

More PLANT PROBLEMS

Begins on page 132



RW USES MESSY WAY to remove dust. It should be transported in closed system or treated to stop nuisance. Air and steam transport dust but cost money.

Small rotary dustless unloader is best for *RW's* job. Sketch shows how unloader is mounted at bottom of dust storage bin. Rate of dust flow from bin to horizontal rotating mixing drum is regulated automatically. Dust is dampened by water sprays, being discharged as a free-flowing mixture. *RW* will need 1 to 1½ gpm of water. This can't be reclaimed. Drive is ½ hp gearmotor.

A J Breugelmans *New York, N. Y.*

COST STUDY that compares a flyash-handling system with manual removal would show a pneumatic system pays off in a very short time. But if *RW* doesn't want to invest in a high-capacity dust-handling system, he can use a rotary feeder and dustless unloader under his "dust extractor."

Spray water is mixed with ashes in ratio of about 15% by weight. This means *RW* can move 50 tons of ashes with about 2000 gal of water. This and normal rains will keep dust down in dump. Also, a binder may be used in dump area to stop dusting.

This suggestion doesn't cut out hand trucks or water. But water use is controlled to proper degree.

Another possible solution of *RW's* problem is to mix flyash with water in a low-pressure evacuator at dust hopper. Pump slurry to fill area or allow it to flow there by gravity. With a flow of 240 gpm of waste water through a 4-in. schedule-80 pipe he will have high enough velocity to prevent dust settling in pipe. This is cheaper than a rotary feeder and dustless unloader but mixing flyash and water is a problem that takes sound engineering.

R P Spreter

Allen-Sherman-Hoff Co, Wynnewood, Pa.

What's Best Way to Check Rectifier?

HERE ARE THE FACTS: We use several selenium disk-type rectifiers to change 24-v ac to 18-v dc. These units have been running for four years, eight hours per day.

Dc output of some of our selenium rectifiers has fallen more than 50%. My understanding is that disk-type rectifiers age about 5% during the first 10,000 hr, but after that stay practically constant. Our experience doesn't confirm this aging.

We've inspected all units with low power output but they appear to be in excellent condition. How do readers check for faults in rectifiers of this type? What kind of faults are most common? How can we recondition units for better service?—*HT*, March *Power*

Here Are the Answers

FOR BEST SERVICE check selenium rectifiers monthly. Check ac voltage to see it isn't greater than rectifier rating. Overvoltage damages stack disks by causing shorts. Overheating shows up as small solder beads on disk underside. Rough blemishes near pressure washers and selenium coatings show where selenium has shorted through.

Ac wattmeter, moving-coil dc voltmeter and ammeter check volt-ampere efficiency. Usual efficiency runs 65 to 85%, depending on circuit. Efficiency should be fairly constant from 20 to 150% load on rectifier.

Aging increases rectifier resistance, reducing dc output voltage 5 to 10%, depending on service. It also lowers efficiency. New units connected to aged stacks may cause current unbalance because forward and inverse resistances are different.

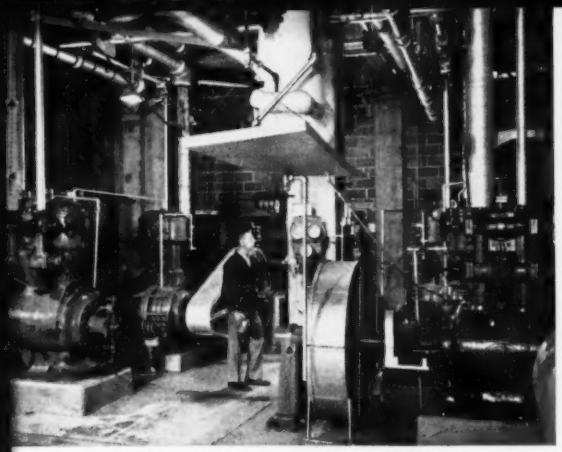
After making electrical checks see that rectifier is free of mechanical damage and hasn't been abused in any way. Look for support or frame grounds. Test each terminal to ground. Excessive dirt lowers stack resistance, may cause shorts in the rectifier.

L W Fitzpatrick

Jefferson City, Mo.

CAUTIONS. Here are some good pointers most manufacturers recommend.

1. Don't connect two separate single-phase bridge stacks to the same phase line with outputs in series to double voltage. This gives you a line short.
2. Don't trouble-shoot with an ohmmeter. Non-linearity of resistance for selenium gives wrong results.
3. Don't let solder, solder flux or



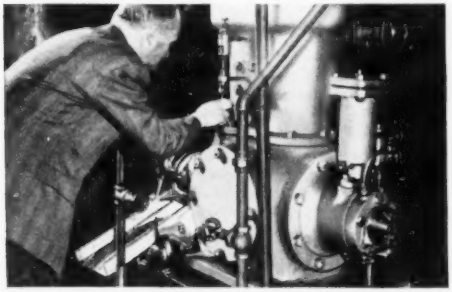
COMPRESSOR EFFICIENCY UP 15%. Six years ago, these Frick compressors were losing efficiency because the oil formed excessive lacquer and carbon deposits. Clogged lines made frequent overhauls necessary. The company changed to Suniso Refrigeration Oil and its natural detergency immediately began attacking the deposits throughout the system. The carbon and lacquer deposits were rapidly carried away to traps and filters, and the system was soon entirely cleaned. Since then compressor efficiency has increased 15%.

SLUDGE AND WAX ELIMINATED. A firm engaged in constructing and servicing industrial refrigeration equipment had constant trouble with compressor oils. Every oil tried lost viscosity excessively under high operating temperatures, vaporized and formed sludge, or formed wax at low temperatures. Complaints were numerous and time lost on call-backs was costly. After consulting compressor manufacturers, the company switched to Suniso. This product immediately solved all sludge, wax and low temperature problems.

SUNISO HELPS INCREASE EFFICIENCY OF 3 REFRIGERATION SYSTEMS

Here are typical examples of how Suniso Refrigeration Oils are helping increase compressor efficiency and are keeping refrigeration system maintenance to a minimum. Following the lead of original equipment manufacturers, more and more maintenance men and refrigeration engineers are safeguarding the efficiency and reliability of their compressors with Suniso.

Suniso Refrigeration Oils meet the requirements of *all* compressors and *all* refrigerants. To get more information, just fill in and mail the coupon below.



SEPARATION TROUBLE ENDED. In this 15-ton ammonia compressor, the oil discolored badly and failed to separate properly from the refrigerant. Excessive amounts of oil carried over into the separators, lowering the efficiency of the entire system. With a switch to Suniso, separation, carryover and discoloration problems ended.

SUN OIL COMPANY—Department P-6
Philadelphia 3, Pa.

☐ Please send me a copy of the illustrated booklet "Suniso Refrigeration Oils."

☐ Please send me a copy of the technical bulletin "Lubrication of Refrigeration and Air Conditioning Equipment."

☐ Please have a Sun representative contact me.

Name_____

Title_____

Company_____

Address_____

City_____ Zone____ State_____

SUN INDUSTRIAL PRODUCTS

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SUNOCO

More PLANT PROBLEMS

Begins on page 132

solder irons contact the rectifier cells.

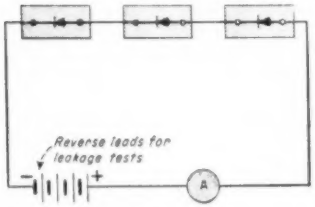
4. Don't loosen nuts holding stack pile together.

5. Never drop or hit stack. This may harm dc valve action, causing excessively high leakage.

6. Never install a standard rectifier in an explosive atmosphere. Use a hermetically sealed oil-immersed selenium rectifier stack assembly instead.

7. Remember that mercury vapors are harmful to selenium rectifiers.

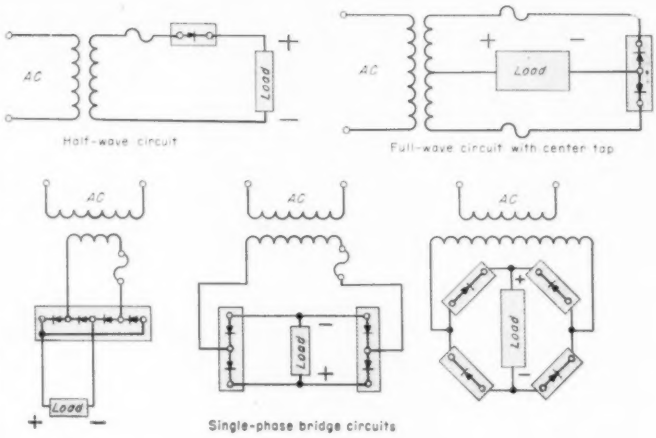
J R SELDEN *Chicago, Ill.*



HOMESPUN TEST that works for us is made as in sketch. When new rectifier arrives we connect battery and ammeter across it and measure current flow. Then we reverse battery leads and measure leakage. Current values in both directions are recorded on rectifier file card. These are called our "standards."

After rectifier is in service for some time and we have any reason to suspect it isn't up to par, we make test again using same voltage. If leakage has increased to two to three times original value, we scrap rectifier.

I. T FORD *Los Angeles, Calif.*



CHECK AC SOURCE to see voltage is constant during 8-hr rectifier runs. Be sure rectifier is wired right. Sketch shows several typical wiring diagrams. See that load isn't too big. Test rectifier with voltmeter and ammeter.

Don't try to adjust selenium rectifiers by tightening or loosening stack nuts. You may change unit characteristics and run into trouble. Engineer from rectifier manufacturer can give *HT* some good pointers on unit care.

Be sure stacks are vertical so air flow around them isn't stopped. Stacks longer than 8 in. often have a floating nut construction and those with brackets have slots in feet. Don't mount stacks near parts that give off heat. These include resistors, tubes, transformers and radiators. If surrounding temperature is continuously above 96 F (35 C) derate stack to accommodate temperature.

Use oil-immersed selenium rectifiers for excessively corrosive or humid atmospheres. Where air is only mildly corrosive or humid, varnish on stack is enough protection.

Fuse ac circuit to stack. Remember that rectifiers age. Dc output is higher when unit is new; it falls as time passes. If load won't take a sufficient range of dc voltages to permit natural aging, reduce ac input when stacks are new.

V W BROOKS *Dallas, Texas*

(*Continued on page 214*)

YOUR NEW PROBLEMS

1 How Can We Keep Air Heater Clean?

Our large steam plant has three types of air heaters—plate, tubular and regenerative. In recent months they have given us trouble. Dirt accumulates on gas sides and there has also been some corrosion.

Two of our boilers are stoker fired; the other two have pulverizers. Stoker-fired units show more corrosion in air heaters than pulverized-fuel units. Gas-side accumulations in plate and tubular heaters are hard; steam lance won't remove them at all.

What I'd like to know is how other POWER readers keep plugging and corrosion troubles in air heaters under control. Will soot blowers clean gas side? Are gas and air recirculation effective? Will they prevent hard deposits?—*JL*

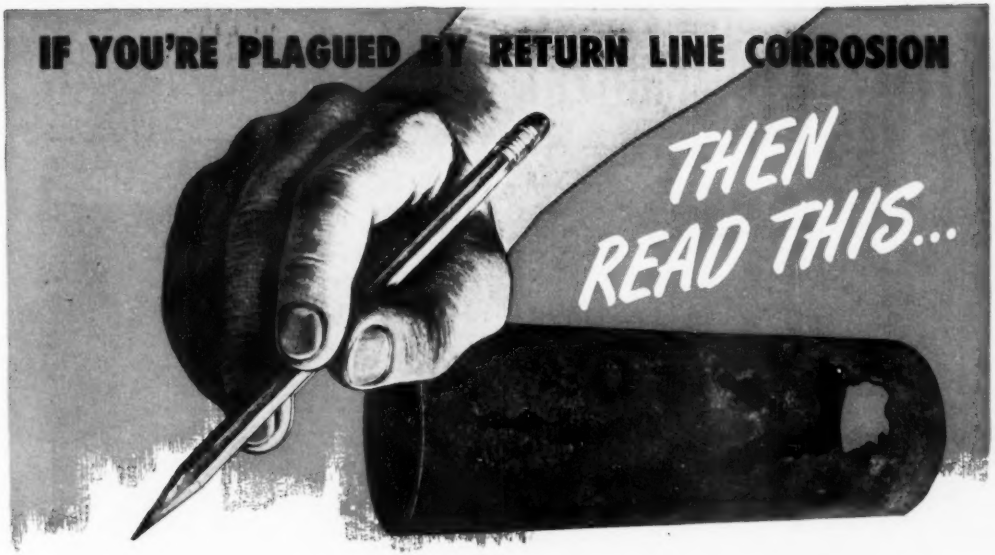
2 Stopping Ceiling Condensation

A dye room in our plant has a steel roof supported by steel beams. Dyeing machines in the room give off much heat and steam. In winter, condensation on underside of ceiling is so excessive that dripping water interferes with production.

Sprinkler heads and type of building construction prevent us from putting up a false ceiling. We've thought of insulating ceiling, but since room is large we'd like to be sure before we go ahead.

Also, room air contains a considerable amount of acid and alkali fumes. Will these injure insulation? Or is a fan that removes air from room better than insulation? Where should we locate fan? What's best material for fan wheel, housing?—*WM*

Will you help readers who sent us problems? Extra pay for photo or sketches.



As an engineer responsible for efficient, economical plant operation, you know only too well that corrosion of steam and condensate lines can send costs skyrocketing through pipe replacement, interrupted production, and increased labor and maintenance. Perhaps you, like many other engineers, have tried stop-gap methods to check the problem only to find them partially effective or far too costly.

Realizing the importance of this major industrial problem, Betz Laboratories has developed its patented filming amine treatment. Here, at last, is a simple, inexpensive, and practically 100% effective method of eliminating this costly and production-disrupting headache.

For example, a linoleum company, operating at 150 psi and producing 300,000 pounds of steam per day, employed sodium zeolite softening for a high bicarbonate raw water. The carbon dioxide content of the steam averaged 40 ppm. Continued maintenance was required due to failure of condensate lines from the steam kettles and unit heaters. After the filming amine treatment was applied, maintenance records showed an annual saving of approximately $8,000.00! And, a large part of this saving was obtained by eliminating weekend over-time work on pipe replacements.

Why not take the first step toward ridding your plant of corrosion *now?* Call in a Betz Engineer. Ask him to show you how Betz *Specialized* Water Conditioning Service can help you . . . quickly . . . economically . . . effectively. W. H. & L. D. BETZ, Gillingham & Worth Streets, Philadelphia 24, Pa. In Canada: Betz Laboratories Limited, Montreal 1.

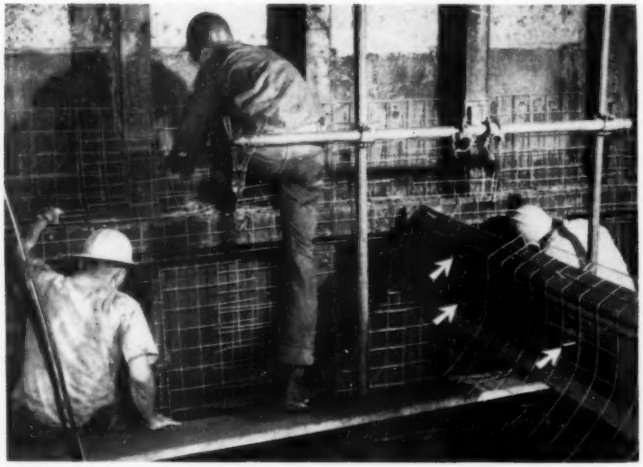
See for yourself how Betz filming amine treatment eliminates return line corrosion and reduces operating costs. Send for Technical Bulletin No. 124.

BETZ

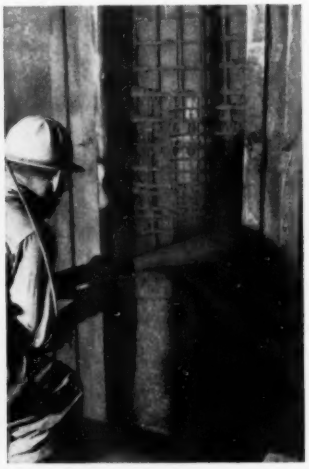
CONSULTANTS ON ALL WATER PROBLEMS

HOW TO PROTECT COAL BUNKERS

By BOB STANLEY, *Grosse Pointe, Mich.*

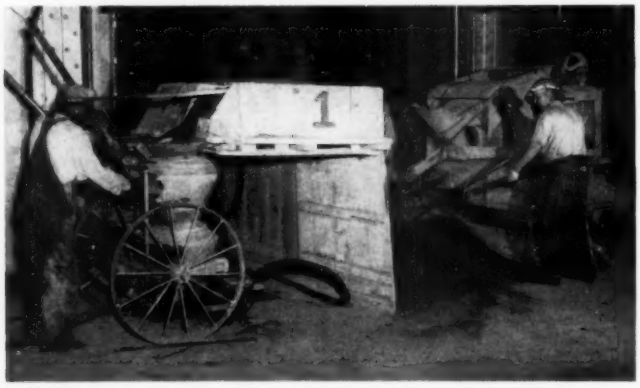


FIRST tack-weld wire loops (arrows at left) for supporting wire mesh, about 1 in. from wall. Stud-weld 3/8-in. by 2-in.-long measuring pieces, for gaging gunite thickness. Cut and bend wire mesh to fit. Fasten mesh to wire loops with wire



COAT with gunite until all wire mesh is covered. Control the consistency of coating with the water valve at the nozzle

FINISHED job leaves smooth 2-in. coating over this vertical column and steel wall, just covering the measuring pins

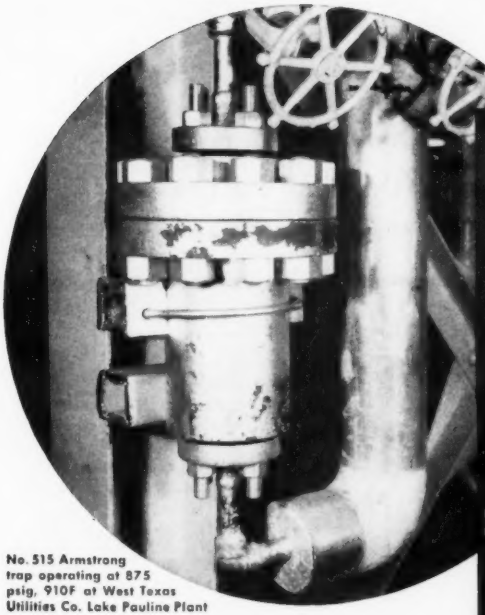


GUNITING takes screened sand, mixed with cement. This is done dry. Equipment used here is same as for flyashing turbine rotors. Mixture is picked up in sandblasting rig at left, compressed air whisks it through rubber hose to the nozzle

SULFURIC ACID formed from moisture and sulfur in coal knocks out metal coal bunkers. Then abrasive action of moving coal wears steel away quickly.

Protect metal with coating of gunite —which is mixture of sand, cement and water. It is sprayed on bunker walls with compressed air. First, tack-weld 3x1-in. wire loops to anchor wire mesh to wall. Next stud-weld 3/8x2-in.-long measuring pins to gage thickness of gunite coating.

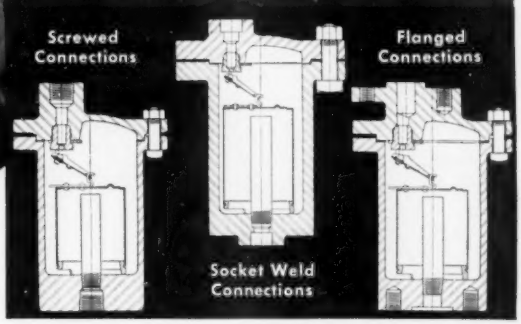
Install wire mesh to support wet gunite. First bend and cut mesh to shape needed, then fasten to wire loops with wire. Next spray until wire mesh is covered. Gunite is like a sandblast. Operator controls water to dry mixture at nozzle with hand valve, to consistency needed. After all the wire mesh is coated, cover to measuring pins' ends.



No. 515 Armstrong trap operating at 875 psig, 910F at West Texas Utilities Co. Lake Pauline Plant

FOR HIGH PRESSURE CONDENSATE DRAINAGE...

(UP TO 2400 LBS.)*



...it pays to use

ARMSTRONG FORGED STEEL STEAM TRAPS!

Because:

1. *They provide dependable automatic drainage* of condensate and boiler carryover for protection of valves, turbines and other equipment.

2. *They have been thoroughly proved* in use in important power plants all over the world.

3. *Armstrong has built thousands of them* since 1929 and has the experience necessary to insure safe design and application. In fact, Armstrong pioneered the development and application of traps for high pressures and has continuously kept pace with the trend to higher pressure plants.

4. *Generous margins of safety are provided,* not only in the forged bodies and caps, but in the power provided for op. ating the valve and in bucket buoyancy for closing the valve. There is no steam waste and no failure to open.

5. *The quality is unsurpassed*—chrome steel valve and seat are hardened, ground and lapped; other working parts are stainless; bodies, caps and bolts and nuts are of materials approved for pressures involved.

6. *The cost is moderate*—first cost because of quantity production, long run cost because of low maintenance.

7. *They are guaranteed to give complete satisfaction.* Your local Armstrong Representative is fully qualified to discuss your forged steel trap applications and to answer your questions. Give him a call, or write:

ARMSTRONG MACHINE WORKS
812 Maple Street, Three Rivers, Michigan

* Many plants, particularly refineries and chemical processing plants use Armstrong forged steel traps at 250 lbs., or less, pressure to secure the advantages of all-steel fittings and freedom from damage in event of fire or explosion.

FOR COMPLETE INFORMATION

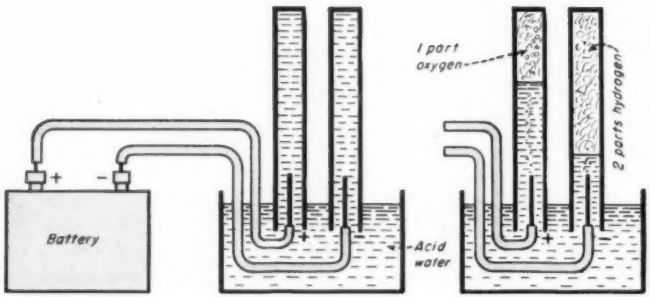
Send for the new 44-page Steam Trap Book—includes physical data and list prices, service pressure rating tables, list of materials and other data pertinent to forged steel traps *plus* information on cast traps and trap selection, installation and maintenance for all condensate drainage jobs. Free on request—no obligation.

ARMSTRONG STEAM TRAPS

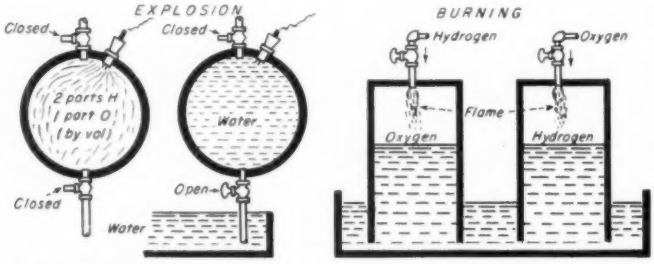
HEADWORK

PHIL SWAIN BRINGS ENGINEERING THEORY DOWN TO EARTH

How Hydrogen Burns



ELECTRIC CURRENT splits water into its constituents, 1 part oxygen *(by volume)* and 2 parts hydrogen. By *weight*, water is 8 parts of oxygen and 1 part of hydrogen



THE PROPORTIONS of hydrogen and oxygen produced by electrolysis form a perfect explosive mixture, *left*. Also note, *right*, that either gas will burn in the other

CHEMICAL FACTS

	Symbol	Relative weight
Hydrogen atom	H	1
Hydrogen molecule	H_2	2
Oxygen atom	O	16
Oxygen molecule	O_2	32

	$2H_2$	+	O_2	=	$2H_2O$
Weights	4	+	32	=	36
	1 lb	+	8 lb	=	9 lb
Volume	2	+	1	=	?

► CARBON AND HYDROGEN are the only important sources of heat in commercial fuels. Although carbon comes first in importance, hydrogen is a big factor, particularly with gas and oil fuels.

Uncombined hydrogen is the simplest and lightest element—a gas so light that one pound fills 188 cu ft. Heating value per lb is 61,000 Btu. Per cubic foot, it's only 325 Btu—much less than manufactured city gas.

The sketches show some interesting facts. As soon as you connect the battery in the first setup, the water starts decomposing into its elements. Oxygen collects in tube over the left electrode (anode, or *plus*) and hydrogen over the right (cathode, or *minus*). At every moment the volume of hydrogen is exactly double the volume of oxygen.

If you then take oxygen and hydrogen in these proportions, and burn them slowly or fast (explosion), they merely recombine to form water, as pictured under "Explosion" and "Burning." After the gases have been recombined by explosion or burning, nothing is left in the bomb but a little water vapor. That's why water from the tank will then be sucked up to fill the bomb completely.

In the sketches headed "Burning" note that a jet of either gas will burn in the other—also, that the water will keep rising until it extinguishes the flame, since there are no gaseous combustion products.

Under "Chemical Facts" note the weight relation; 1 lb of hydrogen combines with 8 lb of oxygen to make 9 lb of water. By volume it is an entirely different story. When gases react chemically, the volumes are proportional to the number of molecules. Thus, 2 molecules (2 volumes) of hydrogen combine with 1 molecule (1 volume) of oxygen.

This volume rule applies only to gases—not to the liquid water produced. In fact, burning 2 cu ft of hydrogen with 1 cu ft of oxygen produces only about 1/600th cu ft of water.

Before You Buy Blow-off Valves ASK THESE QUESTIONS...

EDWARD BLOW-OFF VALVES

Design simplicity . . . operating ease, low maintenance cost . . . stay tight, no trick construction. ASA pressure classes 300, 600, 900-1500, 2500 lb. Sizes 1½", 2" 2½"—straightway or angle flanged or socket welding ends—Stellite or Evalloy trim.

Q. *In a tandem blow-off valve hook-up, will both valves stay tight?*

With Edward, the valve nearest the boiler is the same design as its mate. Both are "sealing" valves.

Q. *Is the packing out of the highest temperature zone?*

Edward blow-off valves have only one set of packing, for the stem is the only working part that needs to be packed. Packing is above a condensate cooling chamber, removed from highest line temperatures.

Q. *Do the valves have backseats, so that packing can be replaced in service?*

With Edward, the answer is "yes".

Q. *Can leakage start through bonnet misalignment?*

Not with Edward blow-off valves. The Edward one-piece bonnet has no yoke posts to permit distortion.

Q. *Are parts of both blow-off valves interchangeable?*

Edward answers "yes". And with fewer working parts Edward blow-off valves need less maintenance. If part replacement is necessary, repairs are easier and less expensive with Edward.

Q. *Can the seat and disk bind together?*

Not Edward, because the disk lifts off the seat on operating instead of grinding against it. There is no sleeve to gall against the seat.

Edward Valves, Inc.

Subsidiary of ROCKWELL MANUFACTURING COMPANY

EAST CHICAGO, INDIANA

1220 West 144th St.

Another Product

Edward built the first steel blow-off valves. Installation records in America's major steam plants for nearly 50 years tell this story—no blow-off valves are better designed for year-in, year-out service with low maintenance. Write for Edward blow-off valve catalog, No. 12-D.

"Jes send fo dat powder monkey," said the fireman

Rocks, Dynamite and Frogs

► WHATEVER ELSE you might think of Marmaduke Surfaceblow, you must admit he's been around. Now that he's anchored as a consulting engineer, the old billy goat is in a more natural setting than when he spent all his time at the Bent Propeller Bar. But yesterday we had a surprise. His dingy old office above O'Houlihan's Machine Shop & Engine Works was closed up tight. So we dropped in at the BP Bar. And there was Marmaduke, ballasting his hold with a cargo of frog legs, rye bread and Sandpaper Gin.

"Shake hands with George Marston, chief engineer of Berk Bros Distillery of Boston," croaked Marmaduke in his bullfrog voice when he looked up. "George and I operated together back in the old days," he added, sending another sling load of cargo down to his mud drum. I shook hands with George, then I joined them.

"Tell us about the time you came ashore in Boston and wound up operating that old brewery," suggested Marston, just as Marmy worked up a 28-inch vacuum on his ballast pump and took a high suction on his bottle.

"BILGEWATER ON BREWERIES," roared Marmaduke, through a mouthful of leaping swamp rabbit, hammering the table for another bottle. "I'll tell you about running a rock-quarry power plant that finally drove me to that brewery job."

George and I sat back while our hero cleared the deck for action. First Marmy lit a piece of rope yarn, then blasted away.

"Back in 1922 I landed at a large stone quarry near Boston," roared Marmaduke. "Massachusetts had the reputation of having the best stationary engineers in those days, so I expected to polish up on the finer points of plant operation.

"'I don't need an engineer,' sneered the hard-boiled rock-quarry owner. 'I've got a fireman who's been making steam since the engineer left last week. He's only a coal stoker, but he keeps things running and that's all any licensed operator can do,' he added, looking me over. 'But I'm hiring you because the law says I've got to have a licensed engineer.'

"The plant had three hrt boilers carrying 100 psi and two 150-hp steam engines. One was a single-eccentric 16x24-in. corliss, with a 12-ft flywheel. This engine was belted to a rock breaker by a 30-in.-wide, 3-ply leather belt.

"The second steam engine was a 13x34-in. Brown. She was double eccentric with gridiron valves and flyball governor. She drove the crusher that turned out gravel, known as 'trap rock,' for road building.

"A third, small, vertical steam engine was direct-connected to a 20-kw dc generator. She was used to generate juice for lights strung around the powerhouse, quarry and office building. But the generator had burned out and kerosene lamps were pinch-hitting.

"There was also a large Sullivan steam-driven single-stage air compressor. She had two flywheels and pounded out 100 lb of air. From her sound, you couldn't tell her from the rock crusher.

(*Continued on page* 202)

Photomicrograph of one type of silica scale in early formation stage. Further deposits will fill in between the "trees" to form a dense, glass-hard, insulating covering that is extremely difficult to remove—and impervious to usual water treatment techniques.

STONE FOREST

(The boiler scale that fought back)

When silica scale was mentioned, water-treatment experts used to change the subject quickly . . . until a plant using The Nalco System began having scaling troubles due to high silica content of the raw water.

That was many years ago. Today, the same plant, operating at 135 psi, maintains 500 ppm (29.4 grains per gallon) silica in boiler water without scaling.

The Nalco research program that solved this low-pressure boiler water silica problem is a continuous one, so that today The Nalco System successfully meets the challenge of silica wherever it arises in the field of water conditioning.

Whether your water treatment problem is silica—or something even tougher—Nalco has the solution, or can put the full facilities of the Nalco Laboratories to work on it for you.

LATEST STUDY ON SILICA CARRY-OVER

At operating pressures over 400 psi another silica problem—that of silica carry-over—often arises. One of the 1951 ASME papers, "Correlation of Silica Carry-over and Solubility Studies" is an up-to-the-minute, informative discussion of this problem. You are welcome to a copy. Just write to National Aluminate Corporation.

NATIONAL ALUMINATE CORPORATION
6222 W. 66th Place • Chicago 38, Illinois

Canadian inquiries should be addressed to Alchem Limited, Burlington, Ontario

THE *Nalco*® **SYSTEM . . . Serving Industry through Practical Applied Science**

JENKINS PRACTICAL PIPING LAYOUTS 62

How to plan a

ZEOLITE (BASE EXCHANGE) WATER SOFTENING SYSTEM

Water softening, the removal of hard water impurities, has found wide application in many of today's industrial and domestic installations. Soft water is most essential in the efficient and economic operation of steam boilers and heat exchangers to prevent the formation of destructive scale deposits caused by impurities in hard water. In processing lines where steam or water is used for washing, pasteurizing, canning, bottling, dyeing, sterilizing, or any other service where impurities must be eliminated, water softening is employed to improve quality of work, economy in amount of cleaning agents used, and elimination of objectionable tastes or odors.

The zeolite or base exchange process is one of the most commonly used methods for water softening. Zeolite is the term applied to natural or synthetic inorganic materials which have the property of exchanging hard water impurities, calcium and magnesium, with sodium. This diagram shows piping connections for a zeolite water softening system with twin softening units. It permits one to operate while the other is being regenerated (replacing used sodium in the zeolite).

The complete water softening cycle consists of Softening, Backwashing, Brining, and Rinsing. After a certain amount of raw water has been softened, the sodium in the zeolite is used up, the process is stopped by operating the valves as indicated in the schedule and the other softening unit is put into operation. The first step in regeneration of the softener is to backwash. In this stage, the flow of water is reversed up through the softener, removing dirt which may have accumulated on the zeolite. The flow rate of the backwash water is controlled by a float operated valve on the discharge into the sump.

The zeolite is regenerated, after the backwash operation, by replacing the accumulated calcium and magnesium with the sodium by running through a brine solution. The zeolite is then rinsed after the correct amount of brine solution has been admitted. This latter operation also removes any remaining brine, making the softener ready for re-use when needed. Depending upon the chemical composition of the water, either iron body bronze mounted or all iron valves are recommended for use on all lines conducting the water before it is completely treated.

The Fig. 40-A All Iron Gate recommended for brine control services in this system is the popular Jenkins U-Bolt Gate. The simple, rugged construction of this valve makes it a practical design for punishing service, especially where sediment is a problem. It is easy to clean, and the removable "Bonnet-Saver Bushing" can be quickly and economically replaced when worn to restore new-valve efficiency. It is available with Iron Body, Bronze Mounted (as Fig. 42-A) as well as All Iron.

Consultation with accredited piping engineers and contractors is recommended when planning any major piping installation.

To save time, to simplify planning, to get all the advantages of Jenkins specialized valve engineering experience, select all the valves you need from the complete Jenkins line. It's your best assurance of lowest cost in the long run. Jenkins Bros., 100 Park Ave., New York 17. Jenkins Bros., Ltd., Montreal. Sold through leading Industrial Distributors everywhere.

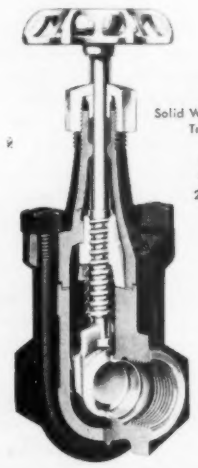


Fig. 40-A
All Iron
Solid Wedge — Inside Screw
Traveling Spindle
U-BOLT GATE VALVE
150 lbs. Steam
225 lbs. O.W.G.

SEND FOR THIS FOLDER It illustrates and describes the unique construction features of Jenkins U-Bolt Gate Valves, and gives complete dimensions. Fill out and mail the coupon today.

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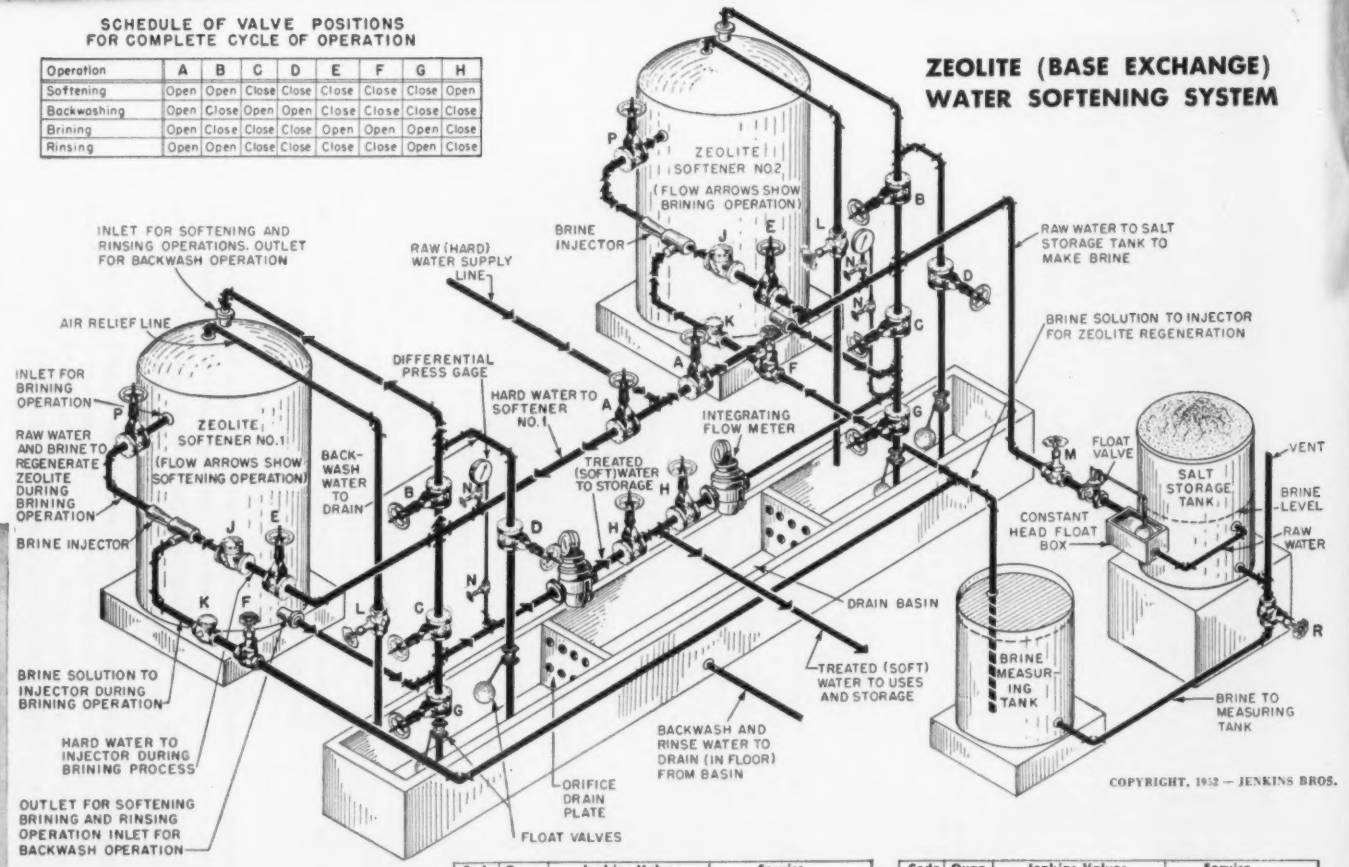
ZEOLITE (BASE EXCHANGE) WATER SOFTENING SYSTEM

SCHEDULE OF VALVE POSITIONS FOR COMPLETE CYCLE OF OPERATION

Operation	A	B	C	D	E	F	G	H
Softening	Open	Open	Close	Close	Close	Close	Close	Open
Backwashing	Open	Close	Open	Open	Close	Close	Close	Close
Brining	Open	Close	Close	Close	Open	Open	Open	Close
Rinsing	Open	Open	Close	Close	Close	Close	Open	Close


ZEOLITE SOFTENER NO.2 (FLOW ARROWS SHOW BRINING OPERATION)
ZEOLITE SOFTENER NO.1 (FLOW ARROWS SHOW SOFTENING OPERATION)
INLET FOR SOFTENING AND RINSING OPERATIONS. OUTLET FOR BACKWASH OPERATION
RAW (HARD) WATER SUPPLY LINE
AIR RELIEF LINE
DIFFERENTIAL PRESS GAGE
INLET FOR BRINING OPERATION
RAW WATER AND BRINE TO REGENERATE ZEOLITE DURING BRINING OPERATION
BRINE INJECTOR
BACK-WASH WATER TO DRAIN
HARD WATER TO SOFTENER NO.1
TREATED (SOFT) WATER TO STORAGE
INTEGRATING FLOW METER
BRINE INJECTOR
RAW WATER TO SALT STORAGE TANK TO MAKE BRINE
BRINE SOLUTION TO INJECTOR FOR ZEOLITE REGENERATION
FLOAT VALVE
VENT
SALT STORAGE TANK
BRINE LEVEL
CONSTANT HEAD FLOAT BOX
RAW WATER
DRAIN BASIN
BRINE MEASURING TANK
BRINE SOLUTION TO INJECTOR DURING BRINING OPERATION
HARD WATER TO INJECTOR DURING BRINING PROCESS
OUTLET FOR SOFTENING BRINING AND RINSING OPERATION INLET FOR BACKWASH OPERATION
TREATED (SOFT) WATER TO USES AND STORAGE
BRINE TO MEASURING TANK
BACKWASH AND RINSE WATER TO DRAIN (IN FLOOR) FROM BASIN
ORIFICE DRAIN PLATE
FLOAT VALVES

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VALVE RECOMMENDATIONS

For details of valves to suit varying conditions, see Jenkins Catalog.

Diagram by Huxley Madeheim
Consulting Engineer

Code	Quan.	Jenkins Valves	Service
A	2	Fig. 651 I.B.B.M. Gate or Fig. 100 All Iron Gate	Raw Water Supply to Softener
B	2	Fig. 651 I.B.B.M. Gate or Fig. 100 All Iron Gate	Control of Cycle Operations
C	2	Fig. 651 I.B.B.M. Gate or Fig. 100 All Iron Gate	Control of Cycle Operations
D	2	Fig. 651 I.B.B.M. Gate or Fig. 100 All Iron Gate	Backwash Drain Line
E	2	Fig. 100 All Iron Gate	Injector Water Shutoff
F	2	Fig. 40-A All Iron Gate	Brine Control to Injector
G	2	Fig. 651 I.B.B.M. Gate	Brine & Rinsing Operation Drain

Code	Quan.	Jenkins Valves	Service
H	2	Fig. 651 I.B.B.M. Gate	Softened Water Shutoff
J	2	Fig. 624 I.B. Swing Check or Fig. 85 All Iron Swing Check	Prevent Backflow
K	2	Fig. 623 I.B. Swing Check or Fig. 84 All Iron Swing Check	Prevent Backflow
L	2	Fig. 106-A Bronze Globe	Air Release
M	1	Fig. 106-A Bronze Globe	Water Supply for Brine
N	4	Fig. 743-G Bronze Needle	Pressure Gage Control
P	2	Fig. 100 All Iron Gate	Brine Connection Shutoff at Softener
R	1	Fig. 40-A All Iron Gate	Brine to Measuring Tank

Illustrating the proved 3-point formula for trouble-free, time-defying hookups

A **Use the right type valve for the service**

B **Place valves correctly in the line**

C **Choose Jenkins for lifetime economy**

JENKINS VALVES

LOOK FOR THE DIAMOND MARK

DEFENSE DIGEST

Your roundup of mobilization news and trends affecting power men

Power-equipment production needs to be expanded if defense power program is to be met, says Defense Production Administration. They indicate following goals: annual production capacity for steam turbines up 3.5 million kw to 15.5 million by Jan. 1954; condensers up 3.0 million sq ft to 13.0; waterwheel generators up 0.5 million kw to 3.0; steam generators up 60.0 million lb per hr to 280; transformers up 25.0 million kw to 88.5.

DPA will use these tentative figures to guide issuance of certificates of necessity and allotment of materials for construction of new facilities.

Battlefield scrap valued at a quarter million dollars is on its way from the Far East to the U. S. The 7700 tons of ferrous scrap includes broken weapons and Army vehicle parts, is first shipment since outbreak of hostilities in Korea.

Remember, scrap – ferrous and non-ferrous – is still vitally needed. Do your part to see that your plant contributes its share.

Makers of power transformers should benefit from an anticipated 20% increase in supply of grain-oriented steel in 3rd quarter of '52, with further increases (up to 60%) possible by mid-1953. But no immediate change in copper situation is foreseen, so National Production Authority encourages manufacturers to continue experimenting with aluminum.

Production of diesels for 750 rpm or less continues at about 1951 levels, although not at capacity. Bottlenecks are being handled by subcontracting and industry is confident of meeting all foreseeable requirements despite some difficulty in procuring forgings and shortage of highly skilled labor.

Major facilities expansion will be virtually complete (94%) by end of 1953. Only the plan for long-range development of ores is expected to run beyond 1954.

Ore program centers in Minnesota's Mesabi and adjoining ranges where rich ores are being rapidly exhausted but where there are vast supplies of low-grade taconite. Over the next six years, big steel producers will spend more than a billion dollars to develop "beneficiation" of taconites.

Steam-condenser shipments slipped behind schedule in 1st quarter, NPA told manufacturers who have asked larger advance controlled materials allotments in 4th quarter and first half of 1953. NPA advised that larger 3rd and 4th quarter allotments will step up delivery of needed circulating and condensate pumps.

Diesel-fuel quality will not be hit in event of war, as was expected. Military Fuels Technical Advisory Committee has reviewed earlier forecasts in light of present estimates of wartime military needs. Their conclusion: These needs will not make serious inroads on blending stocks for civilian diesel fuels.

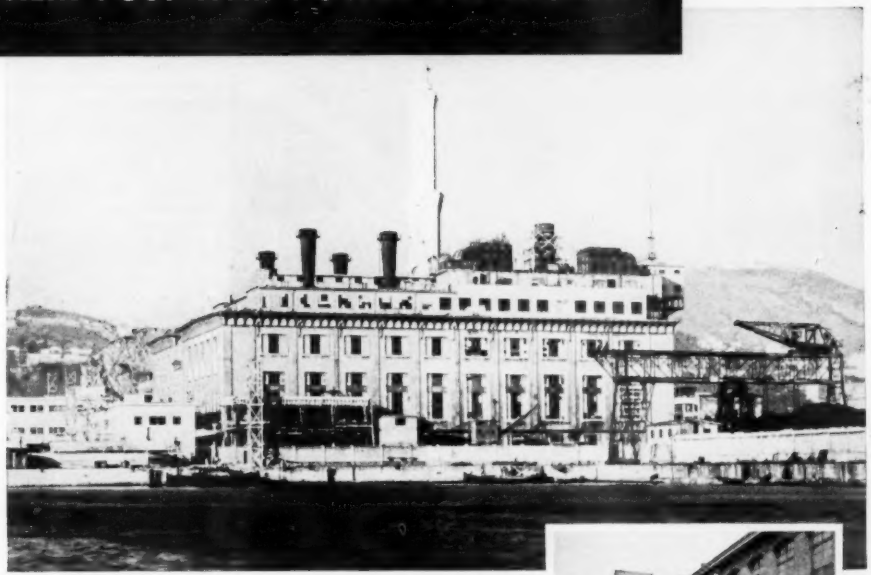
Fabricated piping industry has capacity to meet defense power needs but still faces problems in procuring controlled materials. As much as 85% of products of some fabricators are earmarked for power-plant use.

Columbium-content welding rods may be used in specified cases where satisfactory substitutes are not available. Amended Schedule 5 of NPA order M-80 spells out conditions under which this easing of existing controls may be used.

STURTEVANT FANS WILL AID

Rome · Genoa · Piacenza · Tavazzano · Torino

IN THEIR POST-WAR POWER EXPANSION



Genoa power plant station, as seen from the Genoa harbor.

Here is the first of a series of new steam-electric power plants going into service in Italy. This Genoa station, plus four others located at Rome, Piacenza, Tavazzano, and Torino, will all be served by Sturtevant Fans.

At the Genoa plant, forced draft units consist of four Sturtevant Turbovane TV-10 Fans, each handling 125,000 cfm of air at 150°F and 13.5" of water. All are equipped with Sturtevant Vane Control, allowing instant variation of output to meet any load requirement while the fans are operating at a constant speed.

Boilers are also served by four Sturtevant TVID Induced Draft Fans, rated at 162,000 cfm of air at 320°F and 14" of water. These are equipped with Sturtevant Erosion Resisting Wheels to afford longer wear and lower maintenance costs by minimizing the abrasive action of concentrated fly-ash.

For full information on modern and efficient mechanical draft equipment, contact your local Westinghouse-Sturtevant office, or write to Westinghouse Electric Corporation, Sturtevant Division, Hyde Park, Boston 36, Mass.

Sturtevant TVID Fan being set up for witness tests at Hyde Park, Boston, before shipment to Italy.

TUNE IN ON HISTORY! Only Westinghouse brings you complete coverage of four-month political campaign over CBS television and radio.

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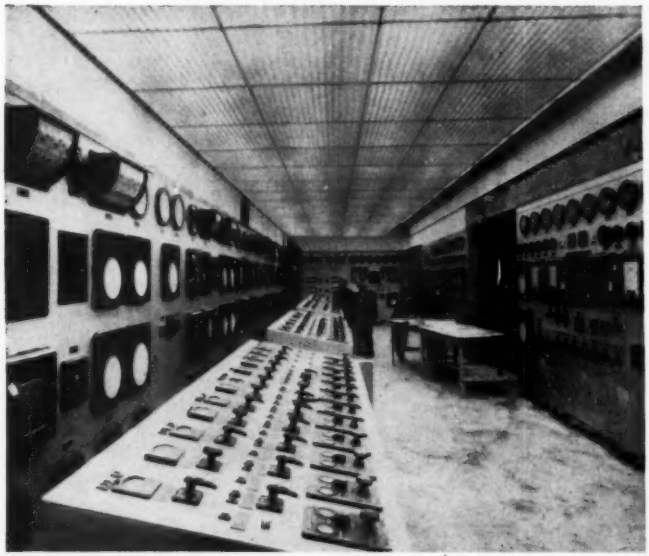


MUTUAL SECURITY AGENCY COMPLETES FIRST ITALIAN STEP

More than 50 American firms have contributed $13 million worth of ECA financed equipment and technical assistance to the Genoa Concentor Power Plant, first step in a proposed 1,000,000 kw increase to Italy's steam-driven generating capacity.

Coming Events

May 28-29 — Spring meeting, Prime Movers Committee, Pennsylvania Electric Assn, Tidewater Inn, Easton, Md. E Gordon, chairman, Potomac Edison Co, Hagerstown, Md.

June 9-12—Air Pollution & Smoke Prevention Assn of America, Statler Hotel, Cleveland, Ohio. Robt T Griebling, exec secy, APSPAA, Mellon Institute, Pittsburgh, Pa.

June 11-13—Wisconsin Power Conference, Associate Engineers and Supplymen of Wisconsin, Schroeder Hotel, Milwaukee, Wis. K W Knoelk, sec, Rt 5, Box 343, Waukesha, Wis.

June 15-19—American Society of Mechanical Engineers, semi-annual meeting, Sheraton Gibson Hotel, Cincinnati, Ohio. O B Schier, meeting chairman, ASME, 29 W 39th St, New York 18, N. Y.

June 23-27—American Society of Mechanical Engineers, Oil and Gas Power Div, Statler Hotel, Buffalo, N. Y. O B Schier, meeting chairman, ASME, 29 W 39th St, New York 18, N. Y.

June 23-27 — American Institute of Electrical Engineers, summer meeting, Nicollet Hotel, Minneapolis, Minn. H H Henline, secy, AIEE, 33 W 39th St, New York 18, N. Y.

What Does the Future Hold for Engineering?

The year 1952 marks the 100th anniversary of the founding of the American Society of Civil Engineers, oldest national engineering society in the U. S. Back in 1852 engineering in America fell into one of two classes, military or civilian, "civil" as the new society called it.

Because of this origin the ASCE decided that its hundredth anniversary should cover a field far broader than present day civil engineering.

Engineering and industry are cooperating to accomplish this goal by running a year-long celebration. The major activity will be in Chicago this summer and early fall with an Exposition and a Convocation.

For the power engineer a symposium on Energy scheduled for September 11 and 12 is probably of greatest interest. All forms of power development, transmission, fuels and effect of energy on economics will be discussed.

In New York City on April 16 the constitutent societies of the Engineers Joint Council held a special meeting to (1) direct attention of its members to the celebration and its phases (2) supply the only scheduled participation of the New York groups in the centennial.

Feature of the meeting was a special report made by Vannevar Bush, president, Carnegie Institution of Washington on the future of engineering. The talk was highly inspiring and points a fast moving engineering growth in the years ahead.

"There are some striking trends throughout the country in science, in engineering, and in industry," says Vannevar Bush. "For one, there has been a great burst of activity in research and development. University and industrial research on peace-time applications, as well as defense projects that are bound to have far-reaching effects, are going ahead at an unprecedented rate.

"Agriculture in its broadest sense is due for extraordinary changes. Science and engineering are entering into this phase of our civilization in far-reaching ways. Progress is certainly becoming apparent. For one thing there are the beginnings of cultivation in the sea, in the place of bare harvesting. In Scotland fiords have been successfully fertilized, greatly increasing the yield of fish. We are learning to raise oysters rapidly by control of nutrient microorganisms. Our Department of Agriculture supplies plans that many farmers are now using for similarly developing stocks of bass in ponds,

(*Continued on page* 186)

The hard, cold facts about Pittsburgh's hot furnaces!

47 PLANTS OKAY THE HEAT PROVER

Pittsburgh's great steel industry needed an instrument to measure air infiltration, to check air requirement and fuel-air ratio controls in open-hearth furnaces . . . an instrument to check the stoves in which blast-furnace air is heated . . . to check precise atmospheres in soaking pits . . . to control fuel waste and precise atmospheres in processing furnaces.

THE CITIES SERVICE HEAT PROVER WAS THE ANSWER . . . and it received the stamp of approval from engineers in 47 different mills in and around Pittsburgh!

Cities Service Heat Provers . . . *not an instrument you buy, but a service we supply* . . . helped to boost furnace productivity through these five unique advantages:

1. Rapid continuous sampling.

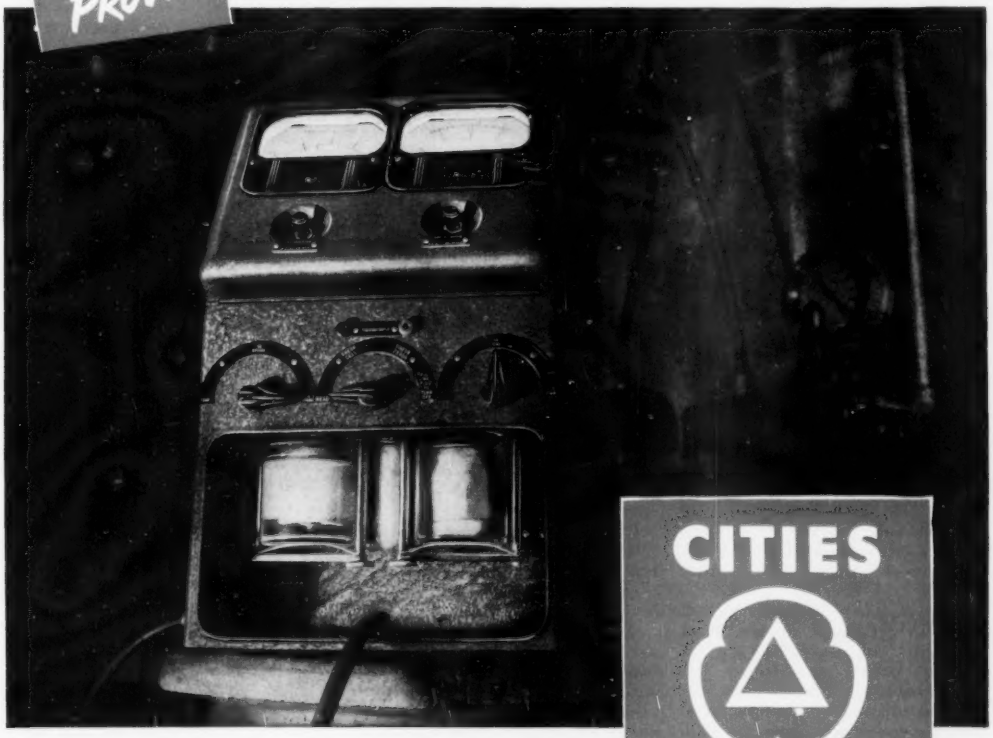
2. Simultaneous reading of oxygen and combustibles.

3. Direct measurement of oxygen and combustibles.

4. Easy portability.

5. No maintenance; no re-calibration.

These points begin to tell you why Cities Service Heat Prover analyses are just as much favored in glass, ceramics, steam generation and other fields as in the great Pittsburgh steel area. For the full story as it applies to you, write CITIES SERVICE OIL COMPANY, Dept. F22, Sixty Wall Tower, New York City 5.

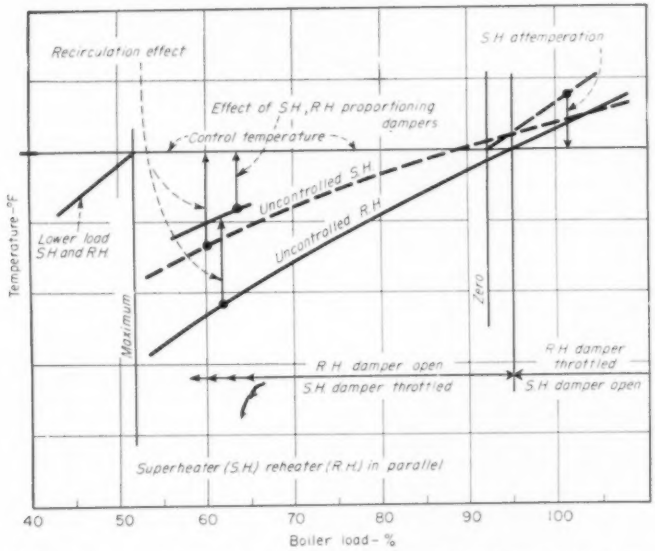


CITIES SERVICE

TECHNICAL BRIEFS

Latest engineering developments for busy power men

12 Digests for you on:
BOILER DESIGN
WATER TREATMENT
CORROSION
TURBINES AND CONTROLS



Higher steam temperatures, a revived reheat cycle with superheater and reheater absorbing 40% of total heat input makes superheat temperature control critical

Boiler Design

Considerations in the Design of Large Central Station Boilers. *By W H Rowand, Babcock & Wilcox Co.*

The boiler designer must produce economically a steam generating unit that satisfies the customer's needs. This requires close cooperation between designer and user.

The first consideration is fuel. Although some plants have reliable and abundant local sources of fuel which makes a single fuel desirable, the majority find it pays to plan for more than one fuel. They can (1) take advantage of relative price fluctuations (2) assure continuity of operation if the normal fuel supply is interrupted.

If only natural gas is burned, fuel storage and handling facilities, ash hoppers, ash pits, and ash handling equipment are unnecessary. Since there are no ash deposits on furnace or convection pass heating surfaces, soot blowers can be omitted. Dust collectors are not needed, and there is no stack discharge problem. Control of heat input to the boiler furnace is simple. The sole disadvantage of natural gas fuel is the potential hazard that exists because of explosive gas accumulations.

A boiler designed for natural gas firing requires a minimum of total enclosure volume because ash hoppers and ash pits are omitted. Eliminating soot blowers and hand lancing or slag inspection requirements increases the unit's adaptability to outdoor service. Heating surfaces can be set for optimum heat transfer and draft loss without considering the manifold problems arising from such ash deposits.

Oil fuel has many of the same desirable features but it requires storage, heating, and pumping facilities. Heating surfaces have to be arranged to minimize trouble from deposits and you need adequate soot blowing equipment.

Coal is the most complicated and troublesome of the major fuels, but is the most universally available now and will be even more so in the future. Its use involves storage and handling facilities, crushers or pulverizers, ash disposal equipment, and usually dust collectors. The stack discharge problem may or may not be troublesome depending on the equipment installed and local conditions. The steam generating unit must incorporate ash hoppers and soot blowing equipment, and must be designed with careful attention to fuel characteristics. The author discusses many of the special problems; shows solution, see Fig. *APC paper. No number.*

Trends in Modern Central Station Boiler Design. *By H B Wallace, Jr, Foster Wheeler Corp.*

Under any economy, power systems and manufacturers alike rely upon experiences gained in one major move to evaluate factors for consideration in the next. This paper deals chiefly with some salient features of modern central station steam generator design that will become the criterions for designing the steam generators of the next decade.

The general trends broadly include these items:

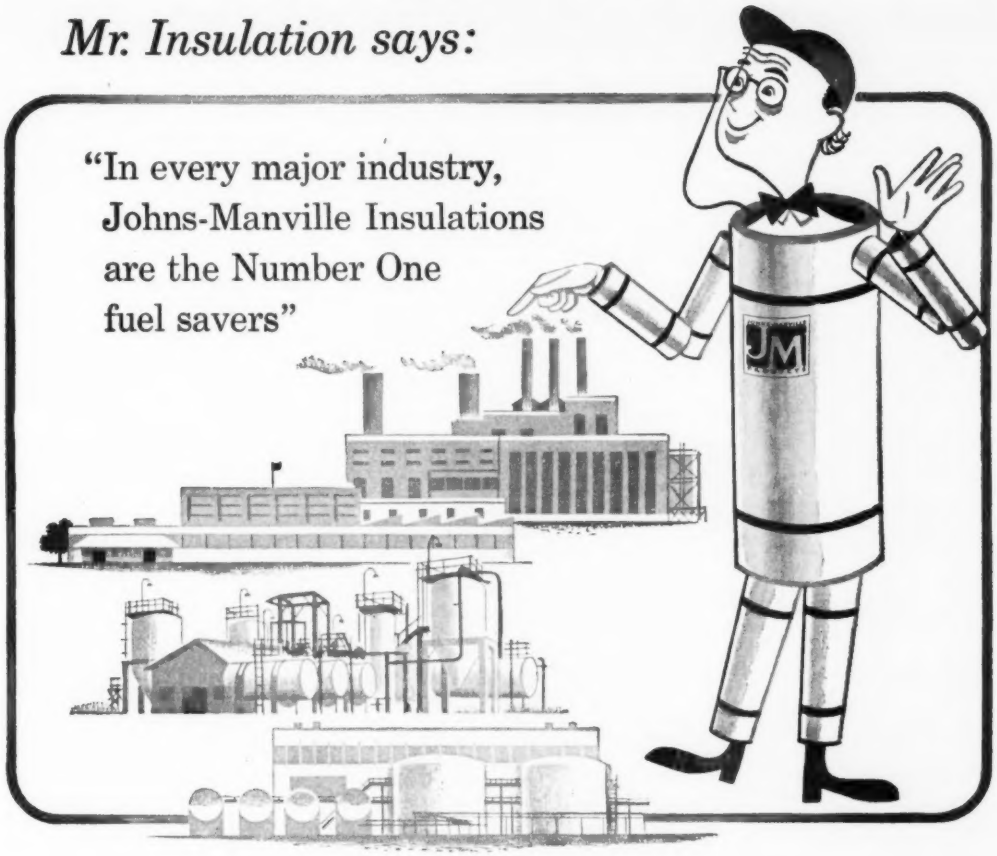
1. Designing to use worse and worse fuels with no penalties in economy.
2. Improving cycle efficiency to offset increasing fuel, labor, materials and construction costs through higher steam temperatures and pressures, reheating and considering multiple stages of reheating, possibly reducing tail end temperatures.
3. Achieving purer steam through dual circulation and improving boiler water conditioning.
4. Considering merits of natural circulation versus forced circulation.
5. Pressurized combustion.
6. Combustion of completely- instead of partially-pulverized coal.
7. Developing quick-starting techniques. *APC paper. No number.*

Water Treatment

Water Treatment at Illinois State Institutions. *By Russell W Lane, State Water Survey.*

To permit competitive bidding the state water survey was charged with providing specifications and supervising treatment at 40 institutional plants operated by the State of Illinois. The coordinated application and control pro-

Mr. Insulation says:



IN PLANTS with stacks or stills, tanks or towers, the story is the same—"Insulation by Johns-Manville" means the maximum return on your investment. There are two good reasons for this:

1. YOU GET THE RIGHT *MATERIALS*—From asbestos and other selected raw materials, Johns-Manville manufactures a wide range of industrial insulations for service from 400F below zero to 3000F above. If you need engineering advice in determining exactly the right one for your job, you can get experienced and authoritative assistance from your local Johns-Manville insulation engineer.

2. YOU GET THE RIGHT *APPLICATION*—Even correctly selected insulation needs proper application to permit it to serve at peak efficiency through the years. Here you can always count on J-M Insulation Contractors and their highly skilled mechanics. These organizations are trained in Johns-Manville application methods, and have generations of insulation experience behind them.

Why not get the complete picture? Call on insulation headquarters when your next job is in the planning stage. Just write Johns-Manville, Box 60, New York 16, N. Y.

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Johns-Manville *first in* **INSULATIONS**

More TECHNICAL BRIEFS

Begins on page 150

SPECIFICATIONS FOR COMPOSITION OF BLENDED CHEMICALS, BY PERCENT

ORGANIC BLEND FORMULA

Soda ash	5.0-15.0
Chestnut tannin	67.5-75.0
Sodium polyphosphate	7.5-12.5
Polyamide or polyhydric alcohol type anti-foam, or equivalent	2.5- 7.5
pH, 1% solution	7.4-8.0

PHOSPHATE BLEND

Disodium phosphate anhydrous	75-80
Corn starch, powdered	20-25

FORMULAS FOR DOMESTIC BOILER BLENDS

Blend	A	B	C
Soda ash	25-28	4-6	25-30
Disodium phosphate	25-28	0	25-30
Sodium sulfite	30-33	40-45	20-25
Sodium polyphosphate	2-4	0	4-7
Sodium nitrate	0	15-20	0
Chestnut tannin	8-10	35-40	8-12
Corn starch	0	0	5-10

gram was exceptionally successful. There was complete acceptance by plant engineers, virtual absence of corrosion, scale and resultant tube replacements, and overall increased efficiency. While considerable time was spent in obtaining this information, it was necessary for proper design of water treatment for each individual plant. Since that time, it has proven invaluable in subsequent calculations for installation of external softening equipment and heat exchangers.

The organic blend formula for internal treatment proved best for general water treatment at different plants, particularly when used with any of several common commercially available chemicals. In this formula, soda ash serves mainly for providing a soluble non-corrosive product of pH 7.4-8.0 in the chemical vat. Chestnut tannin serves as a sludge-conditioning agent, an oxygen absorbent, a scale preventive agent in the feed lines and boiler proper and an organic synergist in foam control. Polyphosphate helps prevent feed line deposits. Anti-foam works as a possible foam preventive agent. During purchase, the supplier is requested to show reliably that the anti-foam can allow an increase in dissolved solids without producing wet steam in boilers operating at superatmospheric pressures.

The phosphate blend formula with its properties of providing proper sludge conditioning and of preventing calcium silicate scale offered best results. The domestic blend formulas, see table, were chosen for complete treatments in the smaller power plants where handling many different chemicals would be inefficient and inconvenient. Certain other required chemicals were bought.

Complete chemical analysis and inspection of the physical properties (uniformity and solubility) of competitive materials are made. Samples are submitted with bids for annual purchases. Awards have been made to the supplier providing the best products at the lowest cost. *APC paper. No number.*

Treatment of Recirculated Cooling Water. *By J K Rice, Cyrus Wm Rice & Co.*

A comprehensive review of the work published since 1940 on treating recirculated cooling water. The results indicate that the level of knowledge concerning all the variables in recirculated cooling water treatment is about the same as the level of knowledge 25 years ago in the internal treatment of boilers. For each of the several popular methods of treatment there are many instances of both success and failure under apparently similar conditions. But there is now considerable effort in evaluating the relative effect of the variables involved; the next few years should see marked progress. *NACE paper. No. 17.*

TO OBTAIN COMPLETE TEXT

Material for these abstracts comes from the following sources unless otherwise stated. Order complete paper from source, not POWER.

National Assn of Corrosion Engrs, annual meeting, Pleasure Pier, Galveston, Texas, March 10-14, 1952. Identified by initials NACE and obtainable through the magazine Corrosion, *Ivy M Parker, Editor, 919 Milam Bldg, 803 Texas Ave, Houston 2, Texas.*

American Power Conference, first annual meeting, Sherman Hotel, Chicago, Ill. March 26-28, 1952. Identified by initials APC and obtainable in the official proceedings. Available through R A Budenholzer, Illinois Institute of Technology, 3300 S Federal St, Chicago 16, Ill. $6.00.

Corrosion

A Laboratory Method for the Study of Steam Condensate Corrosion Inhibitors. *By Harold I Patzelt, National Aluminate Corp.*

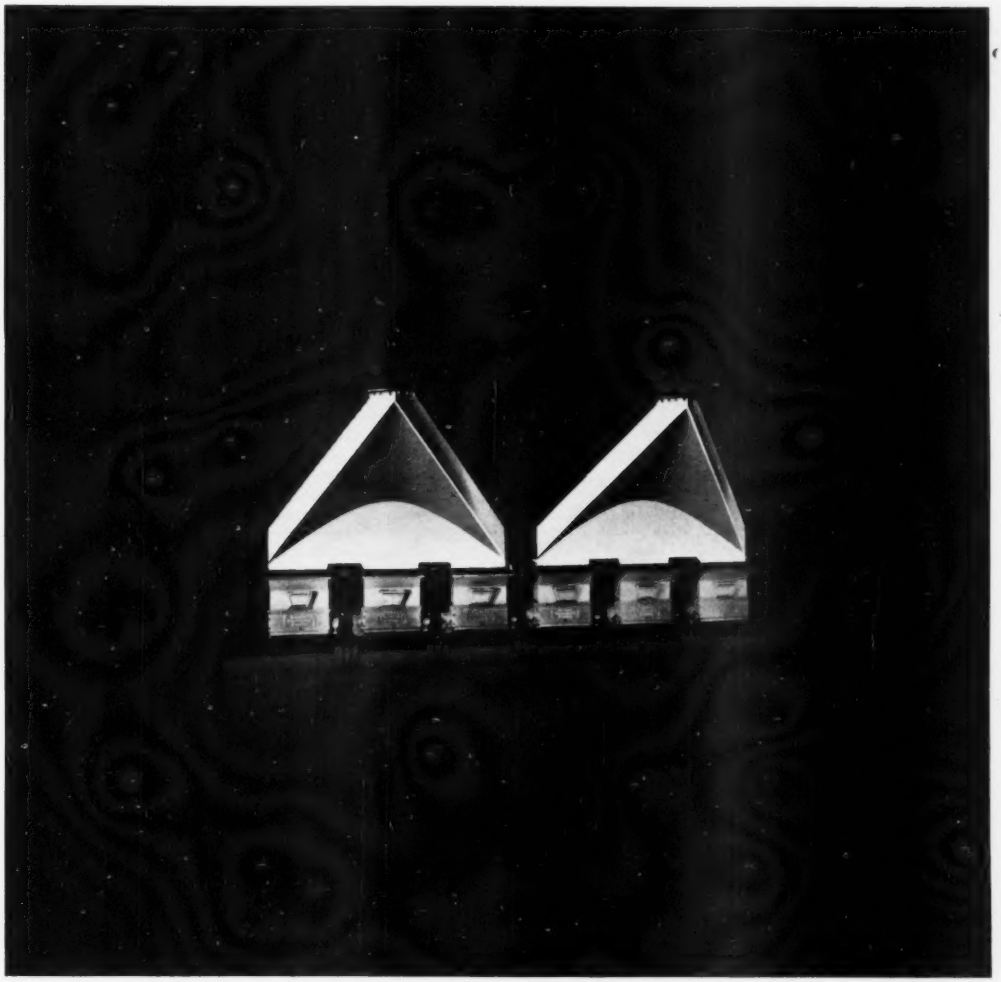
A synthetic condensate is produced in a glass tower by aerating heated distilled water with a mixture of carbon dioxide and air and a solution of the corrosion inhibitor. This condensate is proportioned into a test container by gravity feed. At periodic intervals a metal specimen is removed from the bath and the weight loss determined. The temperature, free carbon dioxide and dissolved oxygen, and the treatment concentration are controlled through the test. Data covers synthetic condensate systems that use sodium hydroxide, sodium polyphosphate, neutralizing and film-forming amines and several other inhibitors. The paper describes how several inhibitors are affected by precorrosion of the test specimen and contamination of the condensate with boiler water. Merits and limitations of this method and possible interpretations of some results are discussed. *NACE paper. No. 20.*

Economics of Industrial Maintenance Painting. *By R R Pierce, Pennsylvania Salt Mfg Co.*

This paper reports results of a research program that still continues. It was begun by the author's company some 18 months ago to determine factors and materials that promote maximum protective life of chem-industrial paint. This research covers 429 individual studies of the protective value of 62 maintenance painting compositions

(*Continued on page* 192)

S-E-Co. Conical Distributors Give Better Stoker Performance



S-E-Co. CONICAL Non-Segregating Coal Distributors deliver a uniform mixture of coarse and fine coal across the stoker hopper. Fuel losses and difficulties in operation of the stoker that are prevalent due to coal segregation are thereby eliminated.

Without coal segregation, combustion occurs evenly across the stoker, the average CO_2 is higher, and the percentage of combustible in the ash is reduced.

The stoker and arches require less maintenance and the fuel burning capacity of the stoker is increased.

Many existing plants have replaced old style flat chutes and weigh larries with CONICAL Distributors and, as a result, have obtained better stoker operation. CONICAL Distributors are indispensable for new stoker installations where designing engineers aim to build a plant giving maximum performance.

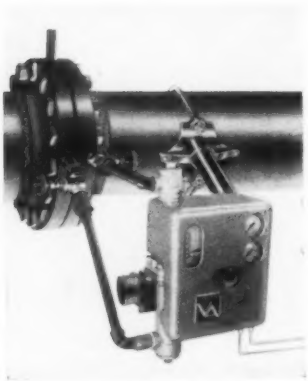
SEND YOUR INQUIRY TO **STOCK EQUIPMENT COMPANY**

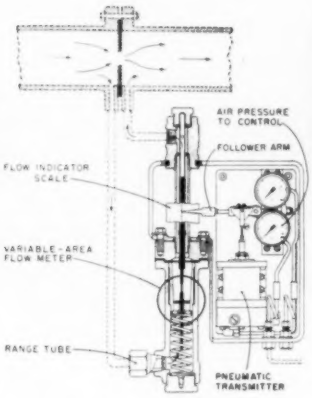
715 C HANNA BUILDING • CLEVELAND 15, OHIO

PLANT EQUIPMENT NEWS

Your information center for new products designed to solve plant problems

Published monthly as a service to readers





ORIFICE FLOW METER MEASURES BY-PASS FLOW

P645 • Known as the *V/A Cell*, this orifice flow meter measures a continuous by-pass stream around the orifice instead of the conventional static-pressure differential across the orifice. Meter has constant flow purging lead lines, linear relationship between by-pass flow and main flow, and simple adjustment of by-pass rate.

By changing range tubes at high pressure tap, differential range can be varied from 50 to 1400 in. of water. Unit has 3 visual indicators: parallax-free flow-indicator scale, air supply scale, and output-pressure gage. Pneumatic transmitter consumes 0.15 cfm of air and transmits 3 to 15 psig. Two models available: one with working pressure rating of 1040 psi at 350 F or 1200 psi at 100 F; the other rated at 2600 psi at 350 F or 3000 psi at 100 F.

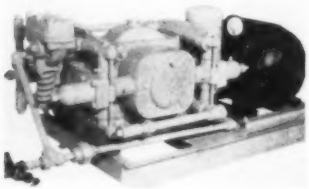
The 9x11x7-in. aluminum cell-case is moisture and fume proof. It can be mounted at orifice flange or up to 30 ft from it.

Fischer & Porter Co, Hatboro, Pa.

PLASTIC PIPE

P646 • *Type WS* pipe features flexibility, light weight and absolute resistance to rot, rust and electrolytic corrosion. Smooth internal surface won't accumulate scale sediment. Recommended for municipal service connections, general construction, natural-gas transmission and similar applications. Installation is rapid, low cost. Special tools and rigging are not needed. Available in nine sizes from ¾ to 6 in. Working pressure is 120 psi at 120 F in sizes up to 1½ in. and slightly less in larger sizes. Smallest diameter is supplied in 400-ft lengths and weighs only 0.216 lb per ft. Largest size comes in 25-ft straight lengths and weighs 5 lb per ft.

Carlon Products Corp, 10225 Meech Ave, Cleveland 5, Ohio



INDUSTRIAL PUMPS

P615 • These high-pressure two- and four-cylinder reciprocating pumps are offered in eight sizes with capacities from 3½ to 60 gpm and pressures from 350 to 1000 psi. Simplified design using a Scotch yoke reduces number of moving parts to minimum. Pumps handle many liquids from water to viscous or abrasive solutions.

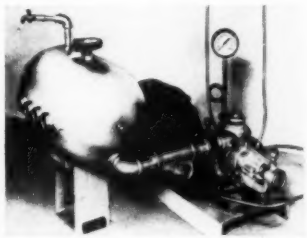
The Royalton Co, Inc, Gasport, N. Y.

VACUUM DEAERATOR

P622 • Cold water vacuum deaeration is most practical way to remove oxygen and carbon dioxide from surface water supplies before pumping them great distances, or from water slated for unit coolers or air conditioning condensing units. This treatment protects pipes, tanks, etc. from corrosion.

Water is sprayed into a deaerator shell kept under a vacuum (29.75 in. of Hg against a 30-in. barometer for water at 40-50 F). Then it moves over a stack of trays or packing rings like Raschig rings and breaks up in the process. Vacuum pumps or steam ejectors draw noncondensables and water vapor upward through the packing to where they leave the deaerator shell. This continual removal scrubs oxygen and carbon dioxide from the surface of the water so a higher partial pressure develops in the lower part of the packing. The higher this partial pressure the lower that of the oxygen and carbon dioxide and hence the less their solubility.

Permutit Co, 330 W 42nd St, New York 36, N. Y.



CONDENSATE RETURN SYSTEM

P618 • Twenty different size pumps to handle 3300 to 33,000 lb per hr of condensate are available in this system. Pressures range from 25 to 150 psi. Tank has convenient inlets for multiple return lines.

Stansbury Engrg & Sales, 53 W Jackson Blvd, Chicago, Ill.

AC WELDERS

P625 • Complete new line of ac welders is available in 200, 300, 400 and 500 amp ratings. Units employ silicone as insulation; combine a low open circuit voltage with arc stabilization to give an extra surge of current if the arc starts to go out; feature automatic hot-start that makes arc-striking easy by providing just the right

For more data on these items, use post cards, p 163. Identify request with P and number.

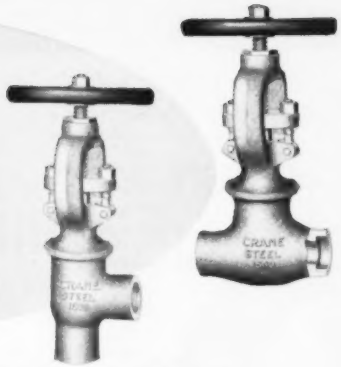
NEW CRANE

SMALL STEEL VALVES

WITH *REVOLUTIONARY* LIP-SEAL
(PATENTED)

BONNET JOINT

1500 AND 2500-POUND CLASSES



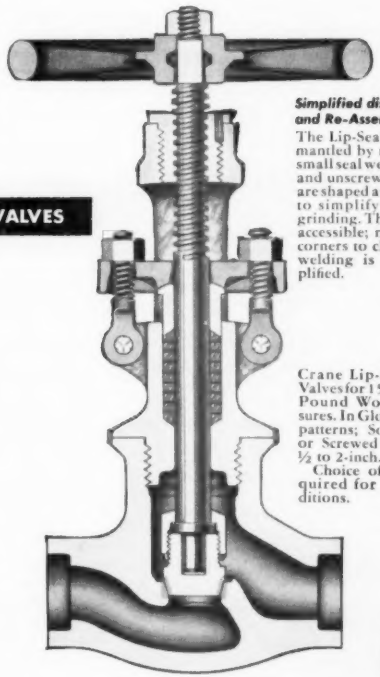
Look closely at the Lip-Seal Bonnet joint of this new Crane small steel valve. A small bead of weld metal seals the joint against leakage—yet the entire mechanical load, both pressure and stem thrust, is carried by strong threaded members.

Here is bonnet joint improvement that brings you important benefits beyond tight sealing and freedom from maintenance.

For example, Crane Lip-Seal design permits a weight-saving, more compact structure without sacrificing strength or reducing seat area. It combines significant developments for improved flow control, ease of operation, and durability. Add to these the ease with which the Lip-Seal joint may be dismantled and re-assembled—and you have a valve with outstanding suitability for your high-pressure/high-temperature power service needs.

DESIGNED AND TESTED TO GIVE YOU:

- **Absolute Tightness**
- **Freedom From Bonnet Joint Maintenance**
- **Minimum Weight and Bulk**
- **Easier Dismantling and Re-Assembly**



Simplified dismantling and Re-Assembly

The Lip-Seal joint is dismantled by removing the small seal weld on the lips, and unscrewing. The lips are shaped and positioned to simplify removal by grinding. They're entirely accessible; no pockets or corners to clean out. Re-welding is equally simplified.

Crane Lip-Seal Bonnet Valves for 1500 and 2500-Pound Working Pressures. In Globe and Angle patterns; Socket-welding or Screwed Ends. Sizes: ½ to 2-inch.

Choice of Steel as required for service conditions.

YOU GET FEATURES LIKE THESE IN LIP-SEAL VALVES

SWIVEL DISC-STEM CONNECTION—Minimizes vibration—provides long pilot guiding for disc. Design makes a more rigid—yet swivel-free—connection.

FULLY GUIDED STEM—Smoother, easier to operate. Fully guided by long yoke bushing and long engagement with lower end of bonnet. Gives positive, straight-line seating.

TWO-PIECE BALL-TYPE PACKING GLAND—Assures uniform load on packing. Prevents binding on stem even when nuts are not pulled up equally.

DURABLE PLUG-TYPE DISC—Has wide seating contact not easily damaged by foreign matter or by wiredrawing. Taper of disc permits close flow regulation while throttling.

STELLITE-FACED SEATING SURFACES—Effectively withstand corrosion and erosion; highly resistant to wear, seizure, galling, and abrasion. Seat is integral with body.

EASY ACCESS TO STUFFING BOX—Ample space within yoke legs allows convenient re-packing. The swinging type gland eye-bolts swing completely clear.

This Circular Ready For You

Your copy of this 8-page booklet supplied free on request. Gives complete information on Lip-Seal Valves, including materials, service recommendations, sizes, and dimensions. Ask your Crane Representative for a copy or write direct.

The Complete Crane Line Meets All Valve Needs. That's Why

More Crane Valves Are Used Than Any Other Make!

CRANE VALVES

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois

Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

amount of current boost to start the arc at any current setting without manual adjustment of welding unit controls.
Metal & Thermit Corp, 100 East 42nd St, New York 17, N. Y.

SPLIT-CORE VOLT-AMMETER

P637 • Type AC-1 volt-ammeter is a clamp-type, hand-sized measuring instrument. Readings are made without breaking circuit or insulation. To read amperes the trigger is pressed, opening pair of insulated jaws so they can easily encircle the power cable. Four ranges are available: 0-12, 0-60, 0-120, 0-600 ac amp. Voltage leads are quickly and safely plugged into the handle of the instrument. Two ranges are available, 0-150, and 0-600 ac volts.
Columbia Electric Mfg Co, 4553 Hamilton Ave, Cleveland 14, Ohio

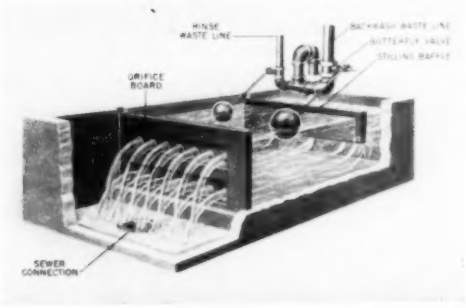
CONSTANT SUPPORT HANGER

P602 • This hanger permits normal longitudinal as well as transverse movement of pipes without introducing additional stresses into piping. Unit has simplified construction, is lightweight, easy to install. It is offered in 25 progressively graduated sizes ranging in travel from 2 to 12 in. and in load capacity from 50 to 8380 lb. Units can be coupled or used in multiple for greater capacity.
Bergen Pipesupport Corp, 50 Church St, New York 7, N. Y

EXHAUST FAN

P608 • Designed for handling dangerous or obnoxious fumes, dirt, heat and smoke, this fan has its driving motor out of air stream. Explosion-proof, enclosed and open type motors are available for fan. Propeller is heavy cast aluminum and ranges in size from 18 to 42 in. Motor rating ranges from ¼ to 7½ hp.
Standard Electric Mfg Co, Inc, West Berlin, N. J.

For more data on these items, use post cards, p 163. Identify request with P and number.

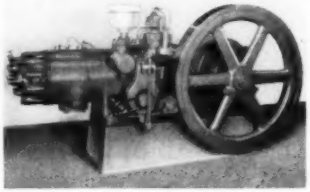


FLOW CONTROLLER FOR WASH AND RINSE

P630 • You can prevent rates of backwashing and rinsing flow from getting too high and at the same time avoid dangers of back-siphonage of waste water with a new anti-back-siphonage wash and rinse controller. The arrangement is standard on all the company's sodium zeolite softeners 54 in. in dia and above. It can also be provided for hydrogen zeolite, anion exchange, pressure type filter requirements. The unit conforms with state and local laws against back-siphonage.
Permutit Co, 330 W 42nd St, New York 36, N. Y.

HORIZONTAL DIESEL

P621 • Model DA is a single-cylinder two-cycle diesel rated 55 bhp at 325 rpm. Bore and stroke is 13 in. *Pickering* governor, *Air Maze* oil-bath cleaner, *McCord* lubricator and built-in 7½-hp *Lorain* gasoline starter are standard equipment. Clutch optional.
White-Roth Machine Corp, Lorain, Ohio



HIGH-SPEED DIESEL

P620 • This 1000-hp unit is lightweight, compact and needs fewer men for maintenance. It is available in both 6 and 8-cyl models with 8-in. bore, 9-in. stroke. Engine can be shipped on a 10-ton truck and unloaded by a small crew using only rollers and crowbars. Two men can install a new liner, piston-rod assembly and cylinder head in 45 min. Other parts are just as easily and quickly maintained by a few men.
Sterling Engine Co, Buffalo, N. Y.

LEAD LUBRICANT

P636 • Heavy duty grease lubricant *Lead-Lube*, has a high lead content in the form of a pulverized lead dust kept in permanent suspension. Function of the metallic lead is to form self-lubricating surfaces over all the wearing parts of gears and bearings to protect surfaces from wear. In the case of older equipment, the metallic lead will re-surface pits and scores.
Knapp Mills Inc, 23-15 Borden Ave, Long Island City 1, N. Y.

INDUSTRIAL DEHUMIDIFIER

P617 • Model WA-5 is supplied in three different ways: (1) for continuous or intermittent operation without automatic control (2) optional plug-in control for automatic operation (3) built-in control on front of unit. Dehumidifier has motor-driven fan and operates on 110-v ac.
Abbeon Supply Co, 179-15 Jamaica Ave, Jamaica, N. Y.

PILOT LIGHT

P647 • *Omni-Glow Model* 1010 is a neon light encased in a nylon tube, which slips through the mounting panel. Lens is available in a wide selection of colors suitable to neon and features *fresnel* lens for more even distribution of light.

Operating on a voltage range from 75- to 250-v ac or dc, the standard Model 1010 withstands vibration and shock, as well as

Some of the Services You Obtain From

HALL System of Boiler Water Conditioning

1. Hall Laboratories studies completely all factors affecting water used to produce steam in your plant.

2. The Hall Engineer responsible for service to your plant sets up procedures for conditioning all waters involved in the generation of steam and power to avoid unscheduled outages.

3. Designated employees are instructed how to make essential control tests and samples are checked by Hall Laboratories.

4. Hall Service Engineers cooperate with your plant personnel to detect difficulties and thus prevent water problems before they occur.

5. Hall Engineers act as "trouble shooters" should water problems arise.

6. The analytical, identification and research facilities of Hall Laboratories are at your disposal for the solution of your problems.

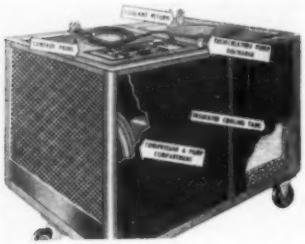
Whether your boiler plant is small or large, low or high pressure, problems of corrosion, foaming, and scale formation must be avoided by the maintenance of suitable water conditions. Hall Engineers have a huge backlog of experience and information on which to draw to help you avoid boiler water problems.

Hall Laboratories' pioneering work in the field of boiler water conditioning has naturally led to the study of other industrial water problems. Now every phase of the use and disposal of water in industry is included in the scope of Hall service. For more information, contact Hall Laboratories, Inc., Hagan Building, Pittsburgh 30, Pennsylvania.

More EQUIPMENT NEWS

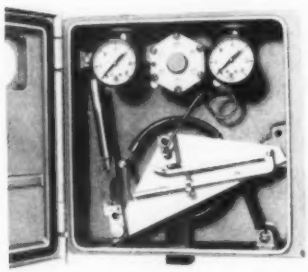
Begins on page 154

voltage overloads that would ruin the usual incandescent pilot light. Other models are available for various operating voltages and degrees of light intensity.
Industrial Devices, Inc, Edgewater, N. J.



PORTABLE REFRIGERATOR

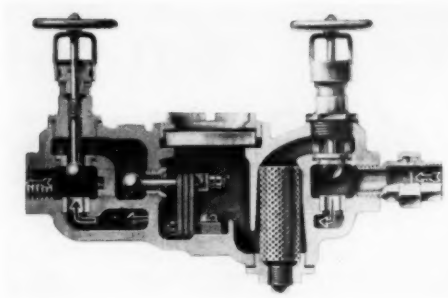
P611 • This is a complete industrial refrigerating system providing maximum portability with thermostatic temperature control over a wide operating range. Designed for automatic recirculation of cold water, brine and other liquid coolants, unit is also available with a heating element for recirculation of hot water. Available in seven models with capacities from ¼ to 3 hp with pump capacities of 1 to 10 gpm. Standard temperature range with water is 38 to 60 F, with brine −10 to 38 F, with heating element 60 to 140 F.
Mayer Refrigerating Engrs, Rutherford, N. J.



PRESSURE-CONTROLLER

P648 • Unitary construction with only one section of piping inside the case features new *Pressure Pilot*. It can be purchased (1) separately or as an integral part of the company's diaphragm valve (2) with or without a pressure reducing valve (3) with or without an air filter (4) with or without a top or side-mounted positioner. You need the reducing valve and air filter only where a clean, constant supply of 20 psi air or gas is not available.

A change in pressure under control registers in a bourdon tube that moves the indicator tip up. This moves a proportional lever and then a flapper through an adjustable fulcrum. Flapper action against a nozzle varies chamber pressure that works against a loaded spring and the pressure from the underside of a diaphragm assembly. When chamber pressure overcomes the spring and diaphragm combination, the diaphragm drops to open a port, more air gets into the control chamber and raises outlet pressure to the control element.
Brown Instrument Div, Minneapolis-Honeywell Regulator Co, Wayne & Windrim Ave, Philadelphia 44, Pa.



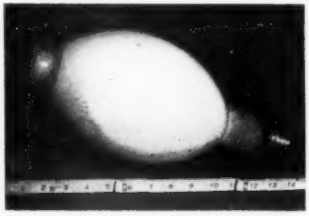
BYPASS TRAP CAN BE REPAIRED IN SERVICE

P601 • Specially designed for processing industries where continuous flow is needed. Trap has two valves that permit bypassing steam and condensate without taking unit out of line. Complete trap element may be replaced while bypass is open. Trap weighs 16 lb, has ½ or ⅝-in. orifice, air vent, check valve, control glass and bypass with indicator.
Velan Engrg Co, 1 Exchange Pl, Jersey City, N. J.

RESISTANCE BRIDGE

P641 • Small, handy measuring bridge designed to take the place of a large wheatstone bridge for measuring resistances in the field, workshop or laboratory. Its small dimensions make it convenient for carrying in coat pocket or briefcase.

Range of this measuring bridge is 0.05 to 50,000 ohms over six ratios. Exceptionally simple to operate, this bridge is always ready for use since the source of supply, a standard flashlight battery, is contained in the case.
Herman H Sticht Co, Inc, 27 Park Place, New York, N. Y.



FLUORESCENT MERCURY LAMP

P635 • The C-H12 fluorescent mercury lamp meets the trend toward larger manufacturing spaces, higher mountings and higher lighting levels both indoors and outdoors. This new light source provides a golden white light suitable for all types of lighting service except where close color discrimination is involved.

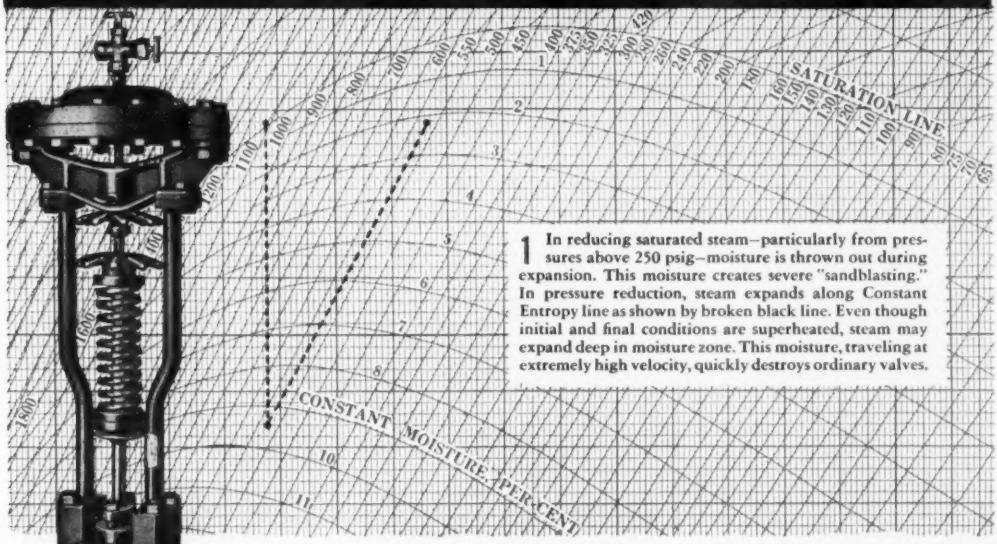
When activated by invisible ultraviolet light from the quartz arc, the phosphor gives off red light. This blends with the blue-green-white light from the mercury arc to give a golden white light with approximately the same color quality as a mixture of equal wattages of mercury and incandescent light. Inside frosting of the bulb provides better light diffusion and greater color uniformity.
Westinghouse Electric Corp, Lamp Division, Bloomfield, N. J.

OFF-CENTER RELIEF VALVE

P649 • Off-center disk-type valve simplifies control of low-pressure saturated steam with small pressure drop. Valve is 8 in. dia

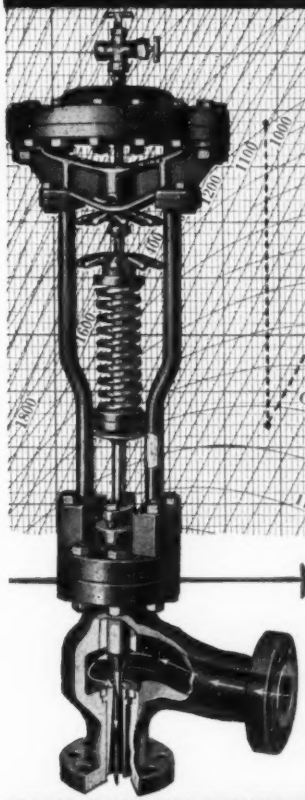
For more data on these items, use post cards, p 163. Identify request with P and number.

Swartwout V-10 Flow Regulating Valves slash maintenance costs in systems with high pressure drop or flashing condensate



1 In reducing saturated steam—particularly from pressures above 250 psig—moisture is thrown out during expansion. This moisture creates severe "sandblasting." In pressure reduction, steam expands along Constant Entropy line as shown by broken black line. Even though initial and final conditions are superheated, steam may expand deep in moisture zone. This moisture, traveling at extremely high velocity, quickly destroys ordinary valves.

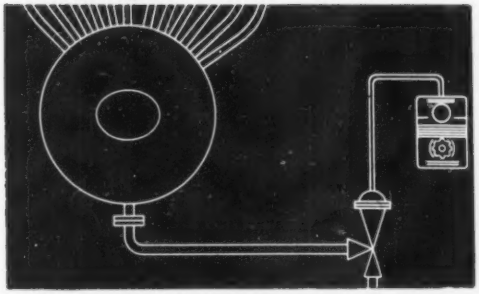
Chart from *Thermodynamic Properties of Steam* by Keenan & Keyes. Reproduced by permission of John Wiley & Sons, Inc., Publishers



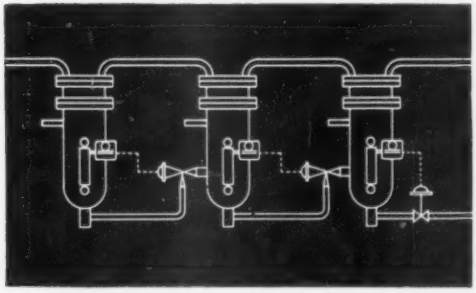
2 Swartwout V-10 valves are scientifically designed to handle liquids at high pressure drops and also under *flashing conditions.* All direct impingement is eliminated and longer valve life is assured two ways—by better flow design, plus use of materials specifically selected for the service involved. As a result, *Swartwout V-10 valves outperform other valves in similar service.*

Swartwout

POWER PLANT EQUIPMENT



3 High pressure boiler blowdown service is extremely rigorous. When closed, there is full pressure drop across valve; when open, high velocities and flashing rapidly increase line loss and decrease the allowable drop across the valve. The variations in pressure make this service critical since valve must handle all conditions.



4 In saturated liquid drainage service, such as on high pressure extraction type heaters, water at saturation temperature flashes into steam when pressure is reduced. Exclusive scroll inlet and gradually expanded straight outlet of V-10 valve design permit a sliding action instead of direct impingement thus preventing corrosion-erosion. A-4208

SEND FOR BULLETIN S-208A • THE SWARTWOUT COMPANY, 18511 EUCLID AVENUE, CLEVELAND 12, OHIO

More EQUIPMENT NEWS

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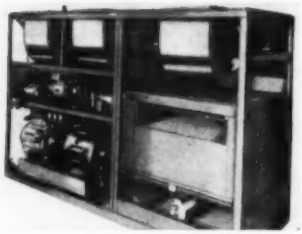


AIR CONDITIONER

P609 • This unit is built to save water and have low operating and maintenance costs. Compressor, evaporative condenser and air-conditioner assemblies are grouped in a single space-saving cabinet. They are shipped completely wired, piped, dehydrated, charged and tested for operating conditions specified for the individual job. Smaller units in 3, 5, 7½ and 10-ton sizes.
The Trane Co, La Crosse, Wis.

CARBIDE COMMUTATOR SAW

P631 • Principal design feature is a brazed ring forming a part of hub and making hub and solid carbide blade completely bonded and rigid. This hub-type solid carbide saw is designed primarily for commutator undercutting. It can be used to advantage on other slitting and slotting work as well. Saw diameter on the new hub type saw ranges up to 3 in.
Gay-Lee Co, Clawson, Mich.

CHECK THESE, TOO! . . .

Compensated Heat Exchanger ..... p 168
Conveyor Lube System ..... p 170
Oil-Tight Pushbuttons ..... p 172
Water-Softener Tester ..... p 172
Steam and Gas Meter ..... p 174
Oil-Tight Control Station ..... p 178
Air and Steam Separator ..... p 180

DIAPHRAGM REGULATING VALVE

P619 • Class DV valve is double seated and is for use with control instruments. It meets all the features required by the various process industries. Available in sizes from 1½ to 10 in. for pressures up to 600 psi.
Leslie Co, 367 Delafield Ave, Lyndhurst, N. J.

and has 150-lb American Standard raised-face flanges. Double crank arm with adjustable weights facilitates accurate setting. Valves are available in smaller and larger sizes and for higher pressures. They are also used in air, gas, liquid and semisolid service for control and shutoff of volume and pressure.
R-S Products Corp, 4600 Germantown Ave, Philadelphia 44, Pa.

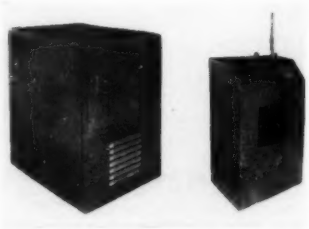
CENTRIFUGAL PUMP

P650 • Two-stage pumps are made in sizes from 2- to 10-in. discharge and capacities up to 4000 gpm and heads to 750 ft. Recommended for high-head waterworks, building-water supply, hydraulic elevators, oil refineries, mines, chemical plants and boiler feed. It has a horizontal split casing with interconnecting passages between the two opposed impellers.

Impellers are nonoverloading type. Their large-diameter shaft runs in heavy-duty dustproof ball bearings. For thrust, an angular contact duplex bearing is used. Bulletin available.
Economy Pump Co, Hamilton, Ohio.

PLASTIC TAPE

P632 • *Tempflex* 105 tape features good chemical resistance and high dielectric strength. Oil resistance qualities make the tape a natural selection for use with oil, as in transformers or diesel equipment.
Irvington Varnish & Insulator Co, 6 Argyle Terrace, Irvington 11, N. J.

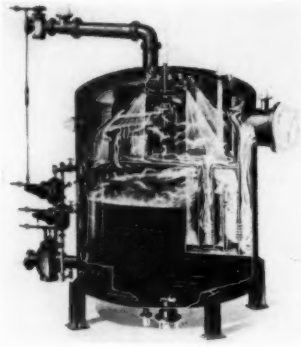


CRANE AIR CONDITIONER

P651 • *Model C-3SP* maintains a temperature of 80 to 85 F within crane cabs when surrounding temperatures reach 130 F. Unit supplies continuous ventilation and has electric strip heaters for winter heating, dust and dirt filters and activated carbon canisters for fume and odor removal. Operation and control is fully automatic. Small compact evaporator section is installed in cab while condenser section is located in any convenient place on crane.
Dravo Corp, Air Conditioning and Combustion Dept, Dravo Bldg, Pittsburgh 22, Pa.

WATER-REPELLENT

P652 • Silicone - base water repellent, *Flexseal*, penetrates masonry up to ¼ in. lining pores but not plugging them. Action is said to make masonry walls self-cleaning, retain repelling powers for at least five years. Can be applied summer or winter in temperatures as low as 15 F provided the wall is dry.
Building Maintenance Div, Flexrock Co, 36th & Filbert St, Philadelphia 4, Pa.



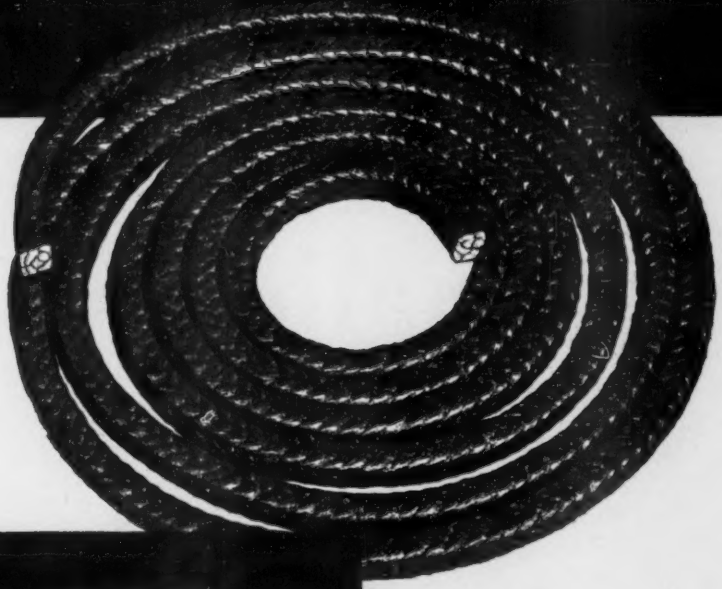
DEAERATOR

P642 • This deaerator has an internal direct-contact vent condenser made of stainless steel. Bulk of heating and removal of

(*Continued on page 168*)

For more data on these items, use post cards, p 163. Identify request with P and number.

A PACKING ADAPTABLE TO MANY USES



905

BRAIDED AND TWISTED ASBESTOS PACKING

Anchor 905 is a square braided asbestos packing with an Ankoprene core and binder throughout the braid. The thorough coating of the asbestos fibers with Ankoprene compound protects the packing body against destruction from certain acid and alkali solutions.

Anchor 905 is used on rods handling gasoline, butane, propane or any of the petroleum-derived hydrocarbon solvents or for use on oil services where the temperature does not exceed 450° F. Finds many uses in chemical plants, gas manufacturing plants, etc. This packing has widespread use today and in it you will find many superior advantages toward better packing service.

In sizes ¼" and up. For full details write today.

BRANCHES

BOSTON, MASS.
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LOS ANGELES, CAL.
NEW ORLEANS, LA.
NEW YORK, N. Y.
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SAN FRANCISCO, CAL.
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GENERAL OFFICES: PHILADELPHIA, PA.

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FIBROUS AND METALLIC PACKINGS FOR EVERY INDUSTRIAL PURPOSE

Stop Costly Shutdowns Due To Valve Stem Failure

"Stemalloy"*

Outlasts The Next Best Stem Material

3 TO 1

Lunkenheimer "Stemalloy" Valve Stems, endurance tested under actual steam-pressure and service conditions, consistently outlasted the next best stem material 3 to 1. If you want to eliminate stem failure, insist on Lunkenheimer Valves. All Lunkenheimer Bronze Valves and Iron Body Bronze Mounted Valves have "Stemalloy" stems. Of the millions in service, *not one has ever been returned due to wear failure.*

WRITE FOR "Lunkenheimer Copper Base Alloys," a useful booklet on valve metals which will help you select the right valve for a given application. It is available from your distributor, or from The Lunkenheimer Company, Box 360A, Cincinnati 14, Ohio.

Fig. 73

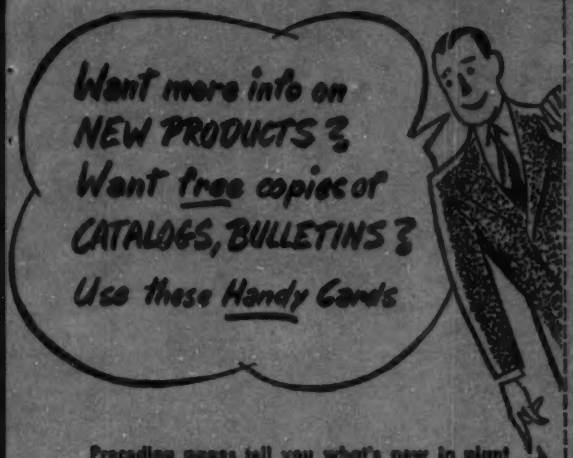
*Patented alloy

BRONZE • IRON • STEEL

LUNKENHEIMER

THE ONE *Great* NAME IN VALVES

L-452-7



Preceding pages tell you what's new in plant equipment. Each item is numbered. For more info on any of them, write in their numbers here

New free catalogs and bulletins are listed beginning on back of this page. To order those you want, write in their item numbers here

Put 2¢ stamp on self-addressed card and mail it to us. We'll pass along your requests to the various companies, they'll send the info

Want quick direct-from-manufacturer service?

USE THESE CARDS

- First check what you need: more information on a new product or an ad, copies of free catalogs, bulletins
- Then describe the product, or literature desired. Give model numbers, bulletin numbers wherever you can
- Be sure to write in number of page on which item appeared, and issue of POWER in which you spotted it
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If you like this quick, direct-to-manufacturer service, we'll gladly send you a supply of cards

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POWER
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New York 36, N. Y.

I want details on these New Products... 6/62

P	P	P	P	P	P

Send me these FREE Catalogs and Bulletins...

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Send me these FREE Catalogs and Bulletins...

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New York 36, N. Y.

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Describe item here

It appeared on page.....of the.....issue of POWER.

My Name.....
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Company.....

Street Address.....

City, State.....

This month's FREE Literature

AIR CONDITIONING, HEATING REFRIGERATION AND VENTILATION

B1 **HEAT PUMP**—Provides summer cooling and winter heating for homes and offices. Packaged unit. 4-page bulletin gives specifications, operation. General Electric Co, 5 Lawrence St, Bloomfield, N. J.

B2 **UNIT AIR CONDITIONERS**—For offices, stores. 5 and 7½-ton units. 4-page bulletin No. 522-B gives dimensions, photos. Frick Co, Waynesboro, Pa.

B3 **PACKAGED AIR CONDITIONER**—10, 15 and 20-ton capacities. Unit features water-saving evaporative condenser. 4-page bulletin 3262-A gives photos, dimensions. Trane Co, La Crosse, Wis.

BOILERS AND AUXILIARIES

B4 **STEAM GENERATOR**—16-page bulletin 522 Rev A gives results of efficiency tests on 2700 and 4500 lb per hr units operating at 235 psi. Curves, charts, photos, description of tests. Vapor Heating Corp, Dept PR, 80 E Jackson Blvd, Chicago 4, Ill.

B5 **SPREADER STOKERS** — Dumping and *Traveygrate* types. 16-page bulletin SB-43 gives cross-section diagrams, operation, construction features, applications. Erie City Iron Works, Erie, Pa.

B6 **BONDING MORTARS**—High temperature type for refractory service. 30-page bulletin No. 42 describes 14 different mortars, gives data for selecting proper one. Also features, uses. J S Marsh, Jr, Laclede-Christy Co, Arcade Bldg, St. Louis 1, Mo.

B7 **LADLE LINING**—For desulfurizing ladles. 8-page bulletin 102 gives method of building wooden form for ramming up monolithic refractory linings, shows how to do the lining. Sketches show entire process. Ironton Fire Brick Co, Ironton, Ohio.

COMPRESSORS AND ACCESSORIES

B8 **AIR COMPRESSOR LUBRICATION**—How lubricants affect compressor operation and how to benefit most from their use. 40-page bulletin with photos, cross-section diagrams, charts. Cities Service Oil Co, 70 Pine St, New York, N. Y.

B9 **EFFECTIVE COMPRESSOR USE**—8-page technical bulletin No. 5 gives suggestions for eliminating losses improving performance. Describes automatic controls and drain traps. Sarco Co, Inc, Empire State Bldg, New York 1.

ELECTRIC AND MECHANICAL CONTROLS

B10 **TEMPERATURE CONTROLS** — For temperature from —300 to +1800 F. Vapor-tight models available. 12-page catalog G-17 describes complete line. Burling Instrument Co, 5 Vose Ave, S Orange, N. J.

B11 **MINIATURE INDICATORS** — Indicating pneumatic receiver provides manual loading and remote index setting. 4-page specification sheet 770 gives description, applications of *Tel-O-Set* units. Minneapolis-Honeywell Regulator Co, Brown Instruments Div, Station 40, Wayne & Windrim Aves, Philadelphia 44, Pa.

B12 **REMOTE PRESSURE RECORDER** — Telodyne unit plus *ElectroniK* potentiometer. 7-page data sheet 10.2-5 shows use, operating principles, specifications. Minneapolis-Honeywell Regulator Co, Brown Instrument Div, Station 40, Wayne & Windrim Aves, Philadelphia 44, Pa.

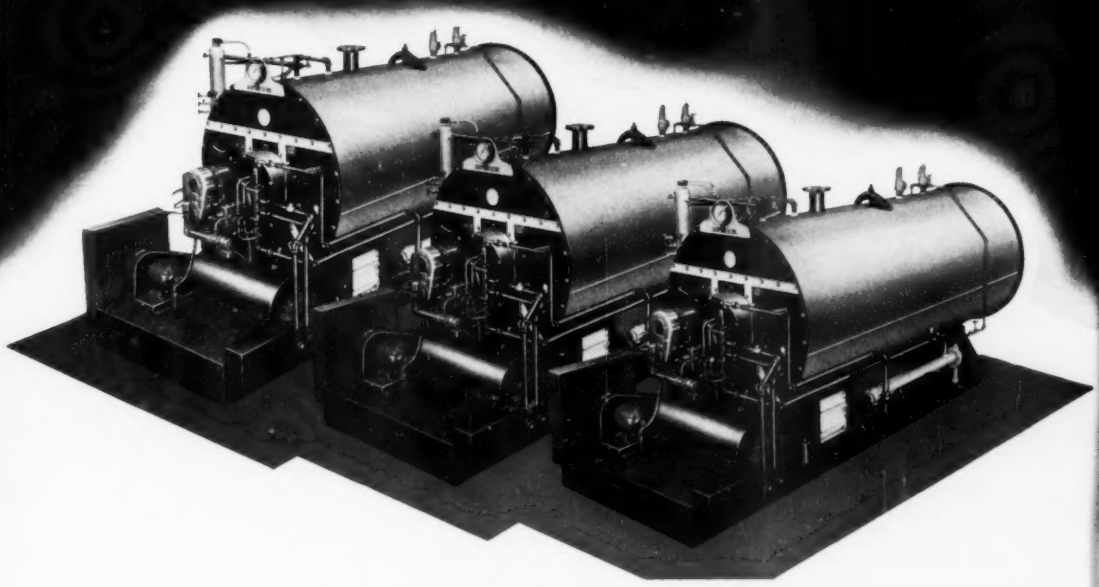
B13 **RATIO TOTALIZER**—Combines input control pressures and spring forces, produces output control pressure based on addition, subtraction, multiplication, division, etc. of input signals. 8-page bulletin 5462 shows design, operation, uses. Photos, diagrams. Hagan Corp, P O Box 1340, Pittsburgh 30, Pa.

(Continued on page 250)

1+1+1=7

WHEN YOU'RE COUNTING

Superior STEAM GENERATORS



Battery installations of Superior Steam Generators provide extreme flexibility to meet the most widely fluctuating steam demands. A hospital installation illustrates the point.

From early June through September, steam demand is limited to the needs of hot water and sterilization. Any one of the three units carries this load with ease . . . and at higher efficiency than could be obtained by minimum operation of a larger boiler.

When cold weather adds its heating load, a second Superior Steam Generator is fired. Only the most severe weather demands firing the third unit . . . which throughout the rest of the year provides stand-by equipment which is desirable in any operation.

By employing different combinations of the three, (7 in all) allowing each unit in turn to share the load; all enjoy longer life at maximum efficiency . . . and by using only the number dictated by the steam demand, maximum economy at every stage of steam demand is assured.

Let us show you how battery installation can serve you better in your new plant . . . or augment your present steam facilities.

Write today for Catalog 401

for performance you can **BANK** *on*

SUPERIOR COMBUSTION INDUSTRIES INC.
TIMES TOWER, TIMES SQUARE, NEW YORK 18, N.Y.

SUPERIOR
STEAM GENERATORS

Photo by Ewing Galloway

Get on Your Feet, Bub

THE THREE-TOED SLOTH is a tropical American animal. He spends his entire life hanging from his hook-like claws among tree branches, eating the juicy leaves, young shoots and fruit.

Sloths are slow-moving, silent and solitary, pretty much on the stupid side. Therefore the expression, *slothful*—meaning lazy, indolent, slow-moving.

Last year, a consultant friend ran into this creature's brother in a large hotel power plant—only he was in human form. My friend was called in to check operating costs, which had skyrocketed steadily. So had breakdowns.

"But I can't understand it," wailed the manager after seeing the report. "The chief's been with me fourteen years. He's a nice guy, never bothers anyone, never beefs about his paycheck, and I always took him for a good engineer."

"Maybe so," was the answer, "but I've never seen a more slothful operator. The bottom is dropping out of your plant, fast."

Then he showed the manager the payoff. In a small room an old daybed had the exact shape of the chief's backside worn into it from constant use. A convenient light for reading, handy cans of tobacco and a radio completed the picture.

"That's how your chief spent most of his time," said my friend to the surprised manager. "He's been on his back, while his flunkies ran your plant into the ground. His slothfulness will cost you the price of a new plant in a few more years."

All this means that power-plant equipment is too important to neglect. Also that it's cheaper to pay a good salary to a top-notch engineer who stays on his toes than to keep a sloth happy on his back.

George Edwards

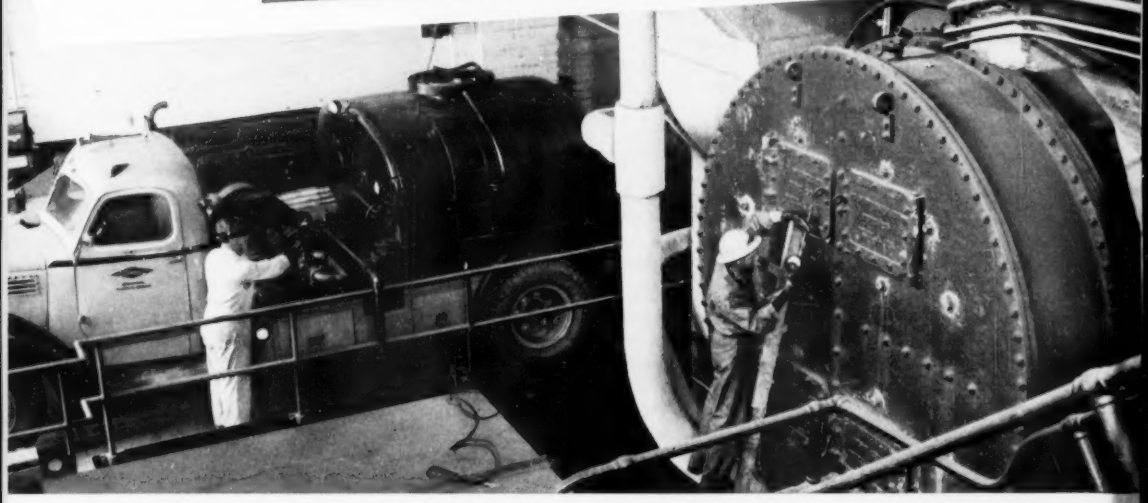
Engineer

DOWELL SERVICE

CHEMISTRY APPLIED TO MAINTENANCE CLEANING PROBLEMS

This Utility asked:

"Can You Clean a Turbo-Condenser Fast?"



Dowell Service lowered back-pressure on turbine 20%... in only 19 hours

It's results that count! Here's the record of an Ohio utility company that called Dowell to clean a large turbo surface condenser.

BEFORE cleaning:

Steam required per kilowatt hour produced = 9.5 pounds
Steam supplied to turbine = 609,000 pounds per hour
Electricity produced = 64,000 kilowatt hours
Back-pressure on turbine = 2.8 inches mercury

AFTER Dowell Service:

Steam required per kilowatt hour produced = 8.93 pounds
Steam supplied to turbine = 562,000 pounds per hour
Electricity produced = 63,000 kilowatt hours
Back-pressure on turbine = 2.2 inches mercury

But that's just part of the story! Only 19 hours elapsed from the time Dowell arrived on the job until the condenser was inspected, found metal clean and placed back in operation. Dowell Service eliminates all scaffolding and dismantling, saving costly downtime. Deposit-removing liquid solvents are applied to the equipment under expert supervision. All necessary pumps and chemicals are brought to the job in special Dowell-designed trucks. And always, proper protection of your installation is the foremost concern of Dowell engineers.

Whether it's heat exchange equipment, processing equipment, water lines or any of a hundred maintenance cleaning jobs, you'll find Dowell Service is fast, efficient and economical. There's a Dowell office located near you to make free estimates on your cleaning problem.

Other recent Dowell jobs:

Before Dowell Service, three boilers were averaging 85,000 pounds of steam per hour. After Dowell Service, performance on each picked up to 100,000 p.p.h.

•

Water well problems? Before Dowell Service, a municipal well produced 87 gallons per minute at 40 feet drawdown. After treatment well produced 800 GPM at 11 feet drawdown!

•

Outage time for die roll in a plastic company costs $1,000 per hour. To clean this roll manually requires 24 hours. Dowell Service cleaned it and had it back in operation in 6 hours.

DOWELL INCORPORATED • TULSA 1, OKLAHOMA

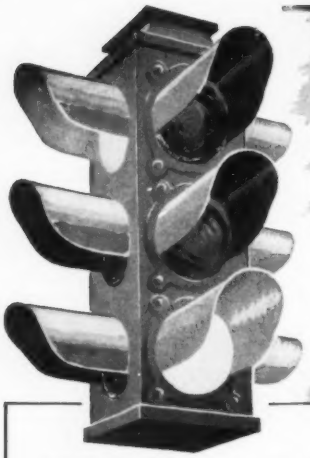
CALL

New York 20	Ft. Worth 2	Atlanta	Mt. Pleasant, Mich.
Boston 16	Chicago 4	Indianapolis	Hamilton, Ohio
Baltimore	St. Louis 8	Louisville	Charleston, W. Va.
Wilmington 99	Kansas City 8	Upper Montclair, N. J.	Salem, Illinois
Richmond 19	Wichita 2	Ardmore, Pa.	Beaumont, Texas
Jacksonville 2	Oklahoma City 2	Anniston, Alabama	Borger, Texas
Buffalo 2	Houston 2	Hattiesburg, Miss.	Midland, Texas
Cleveland 13	New Orleans 12	Lafayette, La.	Wichita Falls, Texas
Pittsburgh 19	Shreveport 69	Dearborn, Mich.	Hobbs, N. Mex

★ *Maintenance cleaning service for industrial heat exchange equipment.*
★ *Chemical services for oil, gas and water wells.*

DOWELL

A Service Subsidiary of
THE DOW CHEMICAL COMPANY



DRAFT FANS

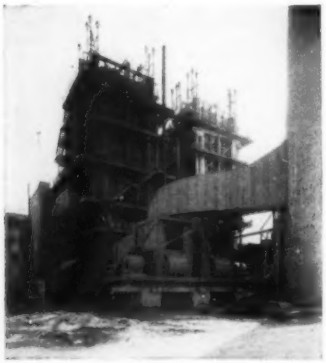
GO

on GREEN

GREEN FANS . . . Used by Many Leading Utilities

One significant fact about Green Fan Installations at the New Orleans Public Service Plant is that two different boiler manufacturers were involved . . . two different types of boilers but Green Draft Fans for all three boilers. Each boiler has two Green Induced Draft Fans and one Green Forced Draft Fan.

When a concern has specialized on an important piece of power plant equipment for many years, that firm is rightly called the "authority" on the subject. This is the position of Green Fuel Economizer Co. in the field of mechanical draft fans. The name Green is synonymous with Draft Fans highly acceptable to industry.



The Line of Green Induced and Forced Draft Fans includes many types in many sizes which are described in Bulletin No. 168. We shall be glad to discuss your fan requirements with your own engineers, with your consulting engineers and with the boiler manufacturer of your choice.

THE GREEN *Fuel Economizer* COMPANY INC.

BEACON 3, NEW YORK

ECONOMIZERS • FANS • AIR HEATERS • CINDERTRAPS

More EQUIPMENT NEWS

Begins on page 154

noncondensable gases is done in second-stage or spray compartment. First-stage heater is primarily a vent condenser. Final and complete deaeration takes place in third or reboiler scrubbing stage. Entire deaerator is built for long life.

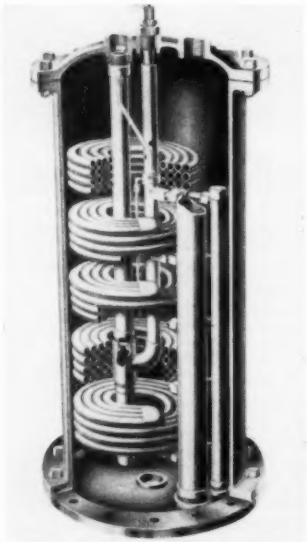
The Permutit Co, 330 W 42nd St, New York 36, N. Y.

For more data on these items, use post cards, p 163. Identify request with P and number.

DIESEL TEST KIT

P606 • Tool No. J 4209-41 includes all equipment needed to check timing, exhaust backpressure, rpm, blower intake restriction, air box, oil, crankcase pressure, plus cylinder-liner position on all series 71 and 6-110 General Motors diesel engines. Also available are tool Nos. J 1319-A and J 4494, compression gages for series 71 and 6-110 and a fuel pressure gage for both series (KMO 320).

Kent-Moore Organization, Inc, General Motors Bldg, Detroit 2, Mich.



COMPENSATED HEAT EXCHANGER

P653 • Where to put the thermostatic bulb on a storage-type heater, or to control any heat exchanging operation, hot or cold, has always been a problem. Bulb in this heat exchanger is located inside a tube that draws samples from top and bottom of tank in proportion to rate of flow. Samples are mixed inside the compensator tube. It governs and acts instantly when any water is taken off. Control is within two degrees on inter-

OUR 60TH ANNIVERSARY

PHILADELPHIA

WORM GEAR SPEED REDUCERS

FOR DEPENDABILITY

Like all quality-controlled products Philadelphia Worm Gear Units reflect not only the workmanship and materials used but also the experience of the maker. All these are strongly evidenced by the economical and dependable performance of thousands of these reducers in service throughout industry today.

The type AT unit shown here is one of a complete line built in a wide variety of horizontal and vertical styles with gear centers from 3″ to 21″. Ratios range from 3⅝:1 to 6300:1 to meet most any application.

Our latest catalog WG-51 gives full details of our worm gear units. Write for a copy using your business letterhead.

PHILADELPHIA GEAR WORKS, INC.

ERIE AVE. AND G ST., PHILADELPHIA 34, PA.
NEW YORK • PITTSBURGH • CHICAGO • HOUSTON • LYNCHBURG, VA.

Industrial Gears & Speed Reducers

LimiTorque Valve Controls

NOW, AS ALWAYS

PABCO PRECISION MOLDED

FEWER MAN-HOURS

85% MAGNESIA HEAT INSULATION

PABCO PRECISION MOLDED INSULATIONS

APPROVED ENGINEERING SERVICE UNIT

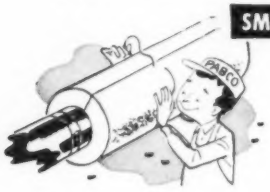
MODERN ENGINEERING demands precise standards of heat insulation performance. Pabco's *Precision Molded* 85% Magnesia combines the time-tested superiority of Magnesia with precision molding to give you a light weight insulation manufactured to very close tolerances.

EASIER TO CUT

Pabco *Precision Molded* 85% Magnesia cuts easily and cleanly. That's because Pabco's manufacturing methods give you "ductile" strength and firmness unprecedented in the field of heat insulation materials.

BLOCKS SCORE CLEANLY

Pabco *Precision Molded* 85% Magnesia Blocks score quickly and cleanly. So important when splitting, or when preparing "hinges" for application to large rounded surfaces.



SMOOTH RIND SURFACE

Because Pabco *Precision Molded* 85% Magnesia is molded to exact final size and thickness, its surfaces are smoother with a finished "rind." Easy embedding of tie wires, a stronger surface . . . and a faster, easier clean-up!

THE DEPENDABLE STANDARD — "MODERNIZED"

quality

PABCO PRODUCTS INC.

INSULATION DIVISION

San Francisco 19 New York 16

Manufacturers of Heat Insulation Since 1920

PABCO ENGINEERING SERVICE UNITS IN ALL PRINCIPAL CITIES

More EQUIPMENT NEWS

Begins on page 154

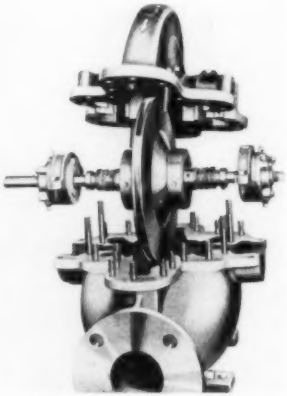
mittent loads, within half a degree on continuous loads up to 80% of total load.

For large installations this exchanger may be used as a combination booster and temperature control in series with storage tanks or shell-and-tube exchangers. No other temperature control is needed on system.

Steam flows through the tubes in this heater, water through the shell. Capacities range from 5 to 300 gpm with temperature rises of from 5 to 150 F.

Aerco Corp, 214 Lafayette Pl, Englewood, N. J.

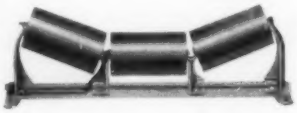
For more data on these items, use post cards, p 163. Identify request with P and number.



GENERAL SERVICE PUMPS

P616 • Standard mechanical shaft seals save floor space, allow shorter shaft and easier servicing of these pumps. Known as Type AS, discharge sizes range from 1½ through 4 in. Capacities range to 750 gpm, heads to 230 ft. General application is for pumping water and clear liquids at temperatures to 200 F where no solids are in suspension.

Peerless Pump Div, Food Machinery and Chemical Corp, 301 West Ave 26, Los Angeles 31, Calif.



CONVEYOR LUBE SYSTEM

P634 • Rigid grease piping to conveyor idlers has been replaced by reinforced flexible automotive-type grease tubing. This tubing will take higher gun pressures, and will not break off in shipment.

Flexible sections are made in lengths

Complete Seating Contact!

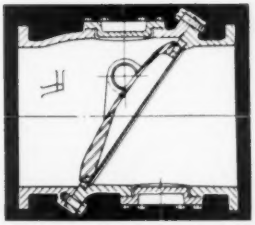
You know you've got it with . . .

CHAPMAN

Exclusive TILTING DISC *Check Valve*

Nothing can "unseat" the disc-ring of this valve from its *drop-tight* contact with the body-ring . . . because clearance at the hinge-pins means that this contact is *complete.* There is no sliding action, consequently no wear, no leakage. And the pivoted disc is cushioned to an easy, silent closing . . . without slam . . . in installations that don't have unusual piping arrangements.

What's more, hydraulic laboratory tests at a top engineering school prove that the specially designed disc and streamlined valve-body reduce head loss as much as 80% under conventional swing-type check valves. See the graphs of these tests . . . and illustrations of the unique construction features of Chapman Tilting Disc Check Valves . . . in Catalog No. 30 (yours for the asking). *Write.*



Cross-section of the Chapman Tilting-Disc Check Valve. A feature of the design is that the disc seat lifts away from the body seat when opening, and drops into contact when closing, with no sliding or wearing of the seats.

THE CHAPMAN VALVE MFG. CO.

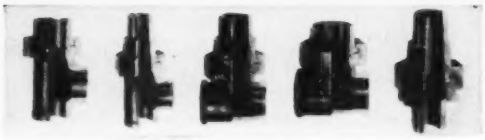
INDIAN ORCHARD, MASSACHUSETTS

Jefferson

AIR-TESTED
AIR-REFINED
MALLEABLE IRON

UNIONS

featuring the
RECESSED
BRASS SEAT

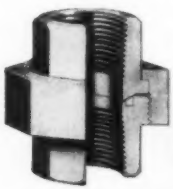


SAVE...
on installation
SAVE...
in maintenance

The use of Jefferson Specialty Unions simplifies piping by reducing the amount of time and labor in making up joints. Furthermore, there are fewer joints to maintain after installation has been made.

The Recessed Brass Seating feature, exclusive with Jefferson Unions, is assurance of permanent tightness without having to exert excess wrench pressure.

In addition to its regular line, Jefferson can furnish AAR male and female unions, Enduro 300#, Excel 250# and Master 150# unions. All types can also be furnished with ground, all-iron seats.



Contact your nearest distributor—or Jefferson direct — on your requirements.

Jefferson UNION CO.
605 W. 26th ST., NEW YORK 1, N.Y.
63 Gooding St., Lockport, N.Y. 39 Fletcher Ave., Lexington 73, Mass.

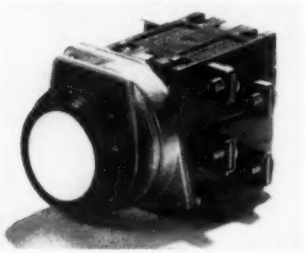
More EQUIPMENT NEWS

Begins on page 154

that allow them to hug inside of inverted angle or channel base. Grease tube is extended to the far side by threading a flexible section through the base to the grease fitting at the near side. Fittings are thus more accessible.

Chain Belt Co, 1600 W Bruce St, Dept PR, Milwaukee 4, Wis.

For more data on these items, use post cards, p 163. Identify request with P and number.



OIL-TIGHT PUSHBUTTONS

P640 • Designed completely on the building-block principle, these pushbuttons feature *self-a-line* contacts and removable color rings for pushbutton identification. Only one basic form of contact block is used in the new units—a single-pole, double-throw type made of *Melamine* for maximum arc resistance. Double-pole, double-throw combinations are made by mounting two of these units on the same base, and tandem combinations giving up to four normally-open and normally-closed contacts can be made by combining four blocks with a simple adapter plate.

Depth of the unit enclosures is 3-7/32 in., and a standard pushbutton extends ½ in. beyond case. Other dimensions depend upon the number of stations in the unit. Contacts are rated at 115, 230, 460, and 575 volts.

General Electric Co, Schenectady 5, N. Y.

COAL PILING

P635 • Power scraper, 60,000-lb or 18-cu-yd capacity, can load itself in half a minute or less to give rapid coal piling and coal movement. It is powered by two diesels of 175 or 190 hp, each with a top travel speed of 30 mph. Each engine powers a drive axle through a torque converter and hydraulically actuated automatic transmission.

Euclid Road Machinery Co, Cleveland 17, Ohio.

SOFTENER TESTER

P624 • Periodic sampling of water leaving a softener gives automatic check on effectiveness of the output. *Hydramizer* takes a sample and subjects it to a soap

uniformly
responsive to

every heat and
power demand

BEACON COAL

EASTERN GAS AND FUEL ASSOCIATES

PITTSBURGH • BOSTON • CHICAGO • CLEVELAND • DETROIT
NEW YORK • NORFOLK • PHILADELPHIA • SYRACUSE

For New England: New England Coal & Coke Co. For Export: Castner, Curran & Bullitt Inc.

an ACCO product

• High test bronze body and bonnet; nickel-alloy disc and seat ring; high tensile, high torque rolled bronze stem—plus large, deep stuffing box easily repacked under pressure—these are the features which make R-P&C Bronze semi-plug and full-plug Globe and Angle Valves outwear ordinary valves. They're fine for frequent or continuous throttling of steam, gas, oil, water. This type valve can be furnished in 200, 300 and 350 lb. pressures.

See your R-P&C distributor for information on the complete line of R-P&C valves or write nearest district office.

ACCO
TRADE MARK
R-P&C VALVE DIVISION
AMERICAN CHAIN & CABLE
Reading, Pa., Atlanta, Baltimore, Boston, Chicago, Denver, Detroit, Houston, New York, Philadelphia, Pittsburgh, San Francisco, Bridgeport, Conn.

R-P&C valves

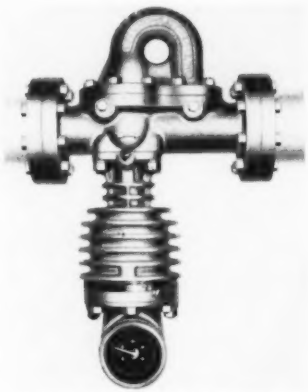
More EQUIPMENT NEWS

Begins on page 154

test for hardness. If water is hard a red light appears. If it is still soft, green light glows. For automatic softeners the *Hydramizer* will actuate valves and for selective automatic or manual units, it rings a bell to warn the operator that regeneration is needed.

Refinite Corp, Omaha, Neb.

For more data on these items, use post cards, p 163. Identify request with P and number.



STEAM AND GAS METER

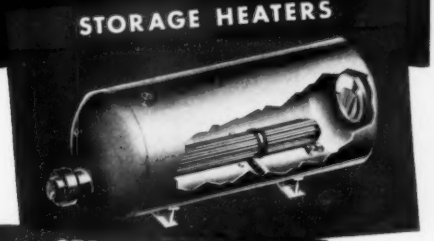
P614 • Model SMKS *Shuntflo* meter is designed for steam, air and gas. It is suited for district heating, departmental and process work in industrial plants and similar services. Dials are located below meter body for easy reading.

Builders-Providence, Inc, 345 Harris Ave, Providence 1, R. I.

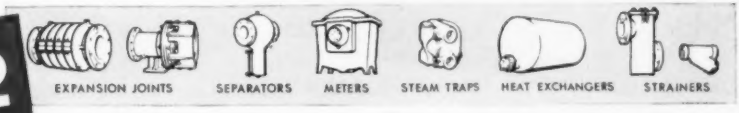
SAFETY RELIEF VALVE

P605 • Type F-51 safety relief valve is for hot-water heating boilers, tanks and heaters. Available in pressure settings from

ADSCO INSTANTANEOUS HEATERS



Choose ADSCO when you want a dependable instantaneous heater. For ADSCO specializes in instantaneous heaters, making all types in any size you need. Heater shells are seamless steel pipe, carefully cut and welded. Tube bundles of pure deoxidized seamless copper tubing formed into U-bends. Semi-steel covers are high-tensile, fine-grained castings. ADSCO heaters are ideal for general service hot water, process work, swimming pools, dishwashing machines... Write for ADSCO's new fact-filled, 56-page bulletin. The most complete,authoritative publication in the industry.



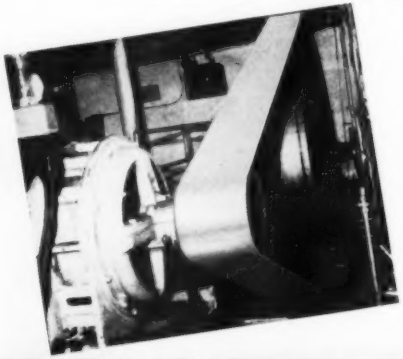
ADSCO
75 YEARS OF LEADERSHIP

AMERICAN DISTRICT STEAM COMPANY, INC.
NORTH TONAWANDA, NEW YORK

Unusual "Tanning"

MAKES H.P. BEHAVE!

In flat leather belting, for instance, Rhoads special tanning processes produce "custom-engineered" Tannate Belting . . . which consistently delivers maximum horsepower. Tannate also minimizes wear on motor and bearings . . . because of its self-adjusting elasticity and its uniform grip across and around the face of the pulley. Because of these and other desirable characteristics, Rhoads Tannate Belting will out-pull and out-last other good belts. Ask your Rhoads sales engineer for details, or write J. E. Rhoads & Sons, 35 North Sixth Street, Philadelphia 6, Pa.



Shown here is a Tannate Uni-Pull drive installed on a refrigerating compressor. The plant engineer in charge claims this Tannate drive increased the efficiency of the machine at least 33%.

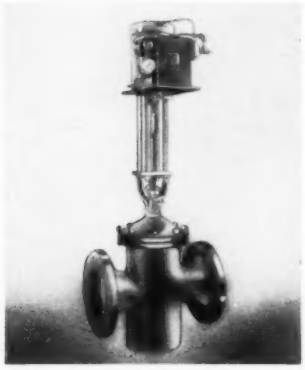
250 J. E. RHOADS & SONS
PHILADELPHIA • NEW YORK
CHICAGO • ATLANTA
YEARS PRODUCING FINE LEATHERS

More EQUIPMENT NEWS

Begins on page 154

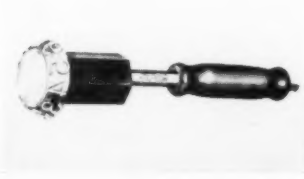
30 to 125 psi with corresponding Btu ratings at various pressure settings. Valve is all-bronze with stainless-steel spring, silicone seat disk.
A W Cash Valve Mfg Corp, Wabash and Morgan, Decatur 60, Ill.

For more data on these items, use post cards, p 163. Identify request with P and number.



THROTTLING CONTROL VALVES

P656 • These valves are the joint work of two firms—Conoflow Corp and Paul Valve Corp. Pneumatic cylinder operators are made by Conoflow, venturi ball valves by Paul. Combination of these units permits easy solution of control problems involving corrosive fluids, abrasive materials, high temperatures and high pressures. These valves can be used in conjunction with standard pneumatic control instruments for automatic control or with manual loading stations for remote manual positioning. Available in sizes to 8 in. in a variety of body materials.
Conoflow Corp, 2100 Arch St, Philadelphia, Pa.



ELECTRIC BRANDING IRON

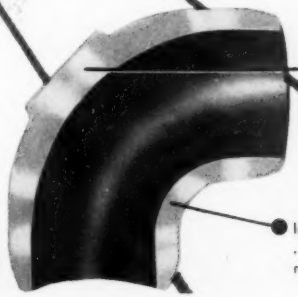
P657 • Irons have numerals 0 to 9 around the periphery of the branding die, and space on face plate at end of die for additional branding copy. Made of special alloy steel that resists scale and corrosion, they are designed to transfer maximum heat in

one of the greatest advancements
for alloy piping systems!

KEY-KAST
ALLOY STEEL
WELDING
FITTINGS

- Produced in all shapes . . . sizes . . . schedules.
- Available in low and intermediate alloys and various stainless steels.
- Bosses provided on all fittings for tapped openings.
- Lower unit cost.
- Controlled quality . . . through rigid metallurgical control.
- Meets A.S.M.E., A.S.T.M., and A.S.A. codes.

New bulletin KS-1 gives complete details how Key-Kast Welding Fittings can give your alloy piping system longer life at lower cost! Wire or write for your copy.



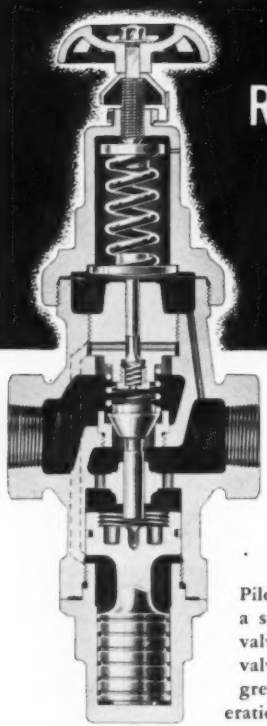
- Greater allowance against corrosion and erosion . . . with extra thickness in critical areas.
- Increased structural strength . . . with greater wall thickness throughout.

key company

Since 1916 . . . manufacturers and developers of products for high temperatures and pressures

DISTRICT OFFICES: NEW YORK • CLEVELAND
CHICAGO • TULSA • HOUSTON • LOS ANGELES

New Features Make MASONEILAN No. 11 Reducing Valve Better Than Ever



Increased Accuracy... Reduced Maintenance

For over 65 years, "Mason" No. 11 Pilot Operated Reducing Valves have been a standard for steam pressure reducing valves. Now new features make these valves better than ever. They provide greater accuracy of control ... ease of operation and serviceability ... longer life ... while *maintenance is reduced to little more than keeping the valve parts clean.*

Compare These Advantages

- Wide range of adjustment, by means of handwheel, without change of spring.
- Indicator provides convenience in setting; automatic retaining device maintains set point during operation.
- Extremely sensitive — responds instantly to any change in load.
- Rugged, compact, easily installed; may be serviced in the line since all parts are removable.
- Extreme precision in fitting and super-finishing of parts insures reliable, accurate performance—reduces maintenance to absolute minimum.

Your local Mason-Neilan Industrial Distributor Is Ready to serve you from stock; or Write—

MASONEILAN

Mason-Neilan Regulator Company

1183 ADAMS STREET, BOSTON 24, MASS., U. S. A.

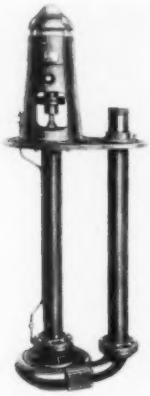
Sales Offices or Distributors in the Following Cities: New York • Syracuse • Chicago St. Louis • Tulsa • Philadelphia • Houston • Pittsburgh • Atlanta • Cleveland Cincinnati • Detroit • San Francisco • Salt Lake City • El Paso • Boise • Albuquerque Louisville • Charlotte • Los Angeles • Denver • Appleton • Corpus Christi • New Orleans Mason-Neilan Regulator Co., Ltd., Montreal and Toronto

More EQUIPMENT NEWS

Begins on page 154

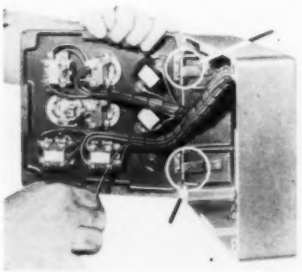
minimum time by means of valve seat contact between die and heater. Three sizes of lettering available, ⅜-, ½-, and ¾-in. **Hexacon Electric Co, 131 W Clay Ave, Roselle Park, N.J.**

For more data on these items, use post cards, p 163. Identify request with P and number.



SUMP PUMPS

P604 • Types VS and VN sump pumps are available in wet- and dry-pit types to handle clear liquids, sewage and other liquids containing solids. Sizes range from 1½ through 8 in., capacities to 1000 gpm, pressures to 250 psi. Type VS has open impeller, multivane bronze or cast iron to specification. Type VN is an open two-vane castiron non-clog impeller. **Warren Steam Pump Co, Inc, Warren, Mass.**



OIL-TIGHT CONTROL STATION

P658 • Designed specifically for machine tool service, cast enclosure has composition gasket between box and cover to insure oil-tight seal. Sliding internal hinge arrangement does not affect seal yet gives hinged-box convenience. Box comes in 6-,

STOP RUST! with RUST-OLEUM®

The Practical Coating!
Beautifies As It Protects!
In All Colors, Aluminum and White!

Cut maintenance costs. Apply RUST-OLEUM directly over rusted surfaces without removing all the rust! Just wirebrush and use sharp scrapers to remove rust scale and loose particles, then apply by brush, dip, or spray. Costly sandblasting and chemical precleaning are not usually required. Specify RUST-OLEUM for every rustable metal surface. Prompt delivery from Industrial Distributors in principal cities.

RUST-OLEUM CORPORATION
2726 Oakton Street, Evanston, Illinois

FREE SURVEY: A RUST-OLEUM specialist will gladly survey your rust problems. He'll make specific tests and recommendations. No cost or obligation. See Sweets for complete catalog and nearest RUST-OLEUM distributor, or write for literature on your company letterhead.

Protects Tanks, Girders Fences, Stacks, Metal Sash, Roofs, Buildings, Marine and Railroad Facilities

Stopping Rust with RUST-OLEUM 769 D.P. Red Primer

Look for this label. Be sure it's genuine RUST-OLEUM!

CLIP THIS TO YOUR LETTERHEAD
MAIL TO: RUST-OLEUM CORPORATION
2726 Oakton Street • Evanston, Illinois

- ☐ Have a Qualified Representative Call
- ☐ Full Details on Free Survey
- ☐ Complete Literature
- ☐ Nearest RUST-OLEUM Source

COMPACT

A 100 H.P. STEAM GENERATOR within arms' reach

MORE STEAM in LESS SPACE... at LESS COST!

The Clayton Forced Recirculation Steam Generator produces more steam per pound of weight and per cubic foot of space occupied than any boiler known... and at less cost. Fast steaming, automatic and safe, the Clayton Generator sets a new standard of efficiency for the production of processing steam. It is the only steam generator with a cost curve that parallels the load demand curve through all stages of operation. Each unit... 15 to 100 h. p.... is complete, ready to connect and operate upon delivery. No burners, pumps, instruments or accessories to buy.

THIS COUPON BRINGS PROOF TO YOUR DESK

An animated, colored flow chart shows you how and why the Clayton Forced Recirculation principle can cut your steam costs.

P-6

CLAYTON MANUFACTURING COMPANY
Box 550, EL MONTE, CALIFORNIA

Send name of nearest distributor and arrange desk demonstration of Clayton Forced Recirculation principle. Send catalog.

NAME_____
FIRM_____
ADDRESS_____ STATE_____
CITY_____

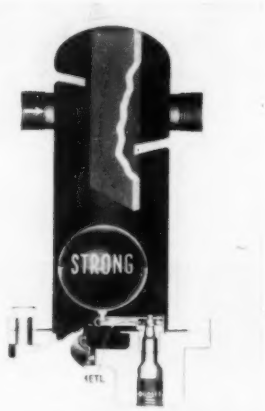
Clayton
MANUFACTURING COMPANY
Box 550, EL MONTE, CALIFORNIA

More EQUIPMENT NEWS

Begins on page 154

9-, 12-, and 16-unit sizes, and optional pushbuttons, selector switches, selector pushbuttons, pilot lights, attachments and accessories are available.
Square D Co, 4041 N Richards St, Milwaukee 12, Wis.

For more data on these items, use post cards, p 163. Identify request with P and number.



AIR AND STEAM SEPARATOR

P607 • For compressed air and steam lines this separator automatically removes and discharges water, oil and scale carried by the air or steam. Available in pipe sizes from ½ to 1½ in. this unit fits small spaces. All working parts are stainless steel, wearable trap parts are *Anum-Metl*, a special heat-treated alloy with long-wearing qualities.
Strong, Carlisle & Hammond Co, Steam Specialties Div, 1392 W 3rd St, Cleveland 13, Ohio

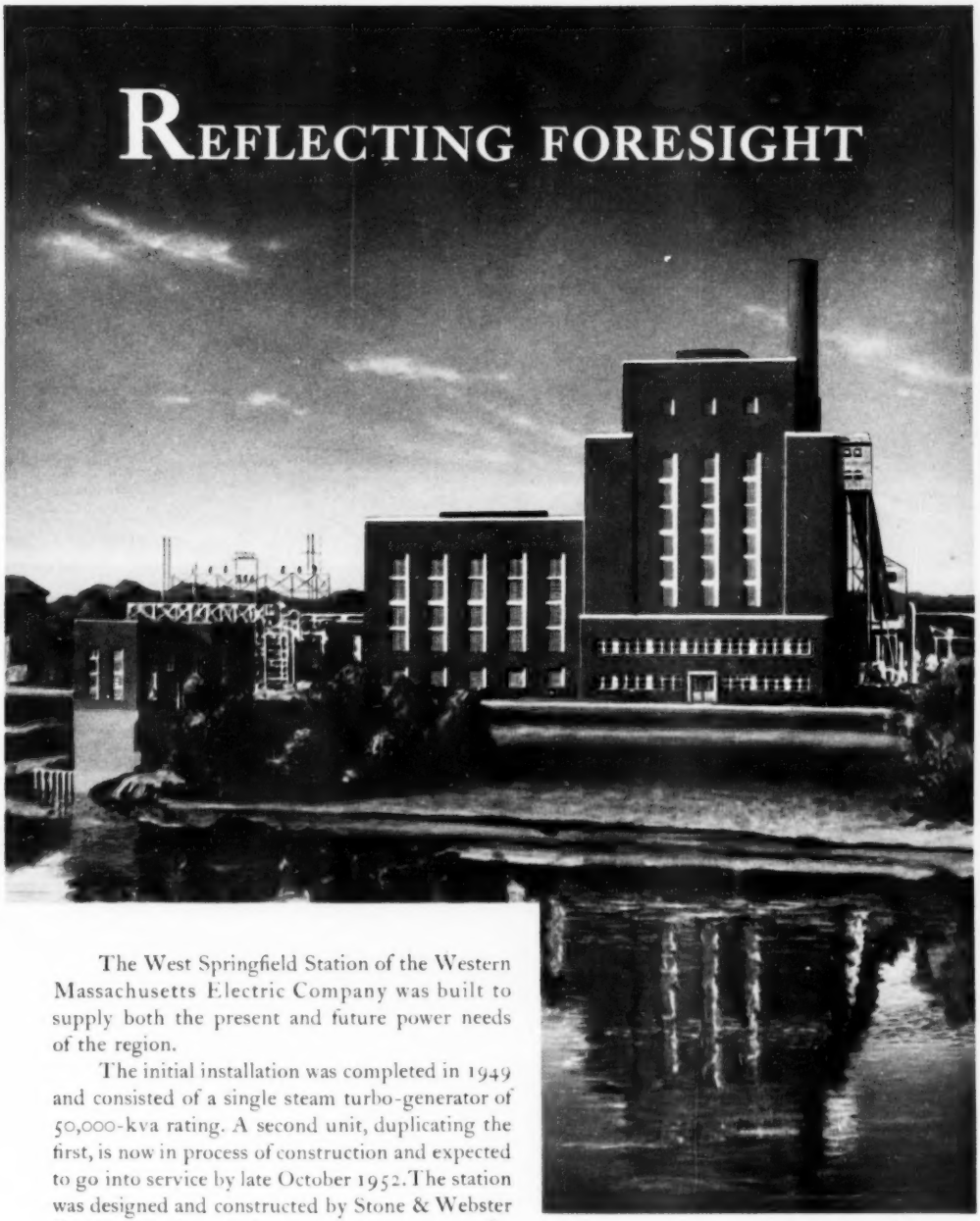
CONTINUOUS V-PACKING

P603 • This chevron-type packing is designed for 500 to 6000 psi in styles for high and low temperatures. Sizes range from ¼ to 1 in. by 1/16 in. increments, 25 ft per spiral. *Continuous-Vee* eliminates need for stocking a number of different sets of V packing. Style No. 2005 is for high-temperature service and is made of asbestos cloth and neoprene. No. 2008 for low-temperatures is made of cotton duck and neoprene.
Mechanical Packing Div, Flexrock Co, 3670-B Cuthbert St, Philadelphia 4, Pa.

LIFT PLATFORM

P623 • Extra-large, 80 cu ft end-dump hopper is feature of 4000-lb capacity, electric, high-lift platform truck designed for

REFLECTING FORESIGHT



The West Springfield Station of the Western Massachusetts Electric Company was built to supply both the present and future power needs of the region.

The initial installation was completed in 1949 and consisted of a single steam turbo-generator of 50,000-kva rating. A second unit, duplicating the first, is now in process of construction and expected to go into service by late October 1952. The station was designed and constructed by Stone & Webster Engineering Corporation.

STONE & WEBSTER ENGINEERING CORPORATION

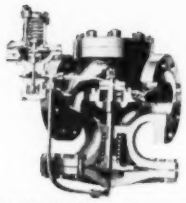
A SUBSIDIARY *of* STONE & WEBSTER, INC.

Looks like we're using **SPENCE REGULATORS** *all over our plant*

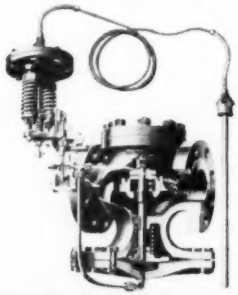
This busy plant has ordered and re-ordered Spence Regulators for two good reasons. (1) Spence offers a *wide-range line* to handle a host of regulating jobs. (2) What's more, Spence units give accurate service year after year. Maintenance is negligible. Over-all costs are low. These design features explain why . . .

- **Single Seat Packless Construction**
- **Large Balanced Metal Diaphragm**
- **Sensitive Pilots**
- **SECO Metal Seats and Discs**
- **Springs out of path of steam**
- **No dismantling for inspection**

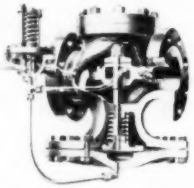
Write for Bulletin 350 for complete details on Spence's line of automatic regulating valves.



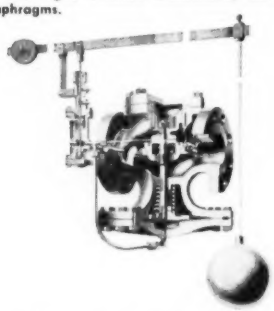
PRESSURE REDUCING—Self-operated, dead-end regulators powered by large, frictionless, metal diaphragms. Sizes ¼ in. to 12 in. Pressures to 600 psi 750F.



TEMPERATURE REGULATING — Combined temperature and pressure control. No separate reducing valve required. Shuts tight, will not wiredraw or be damaged by overheating. Sizes to 12 in.



BACK PRESSURE CONTROL—Wide selection of sensitive pilots to meet exacting requirements. Initial pressure closing, guaranteed to shut tight. Packless construction, metal diaphragms.

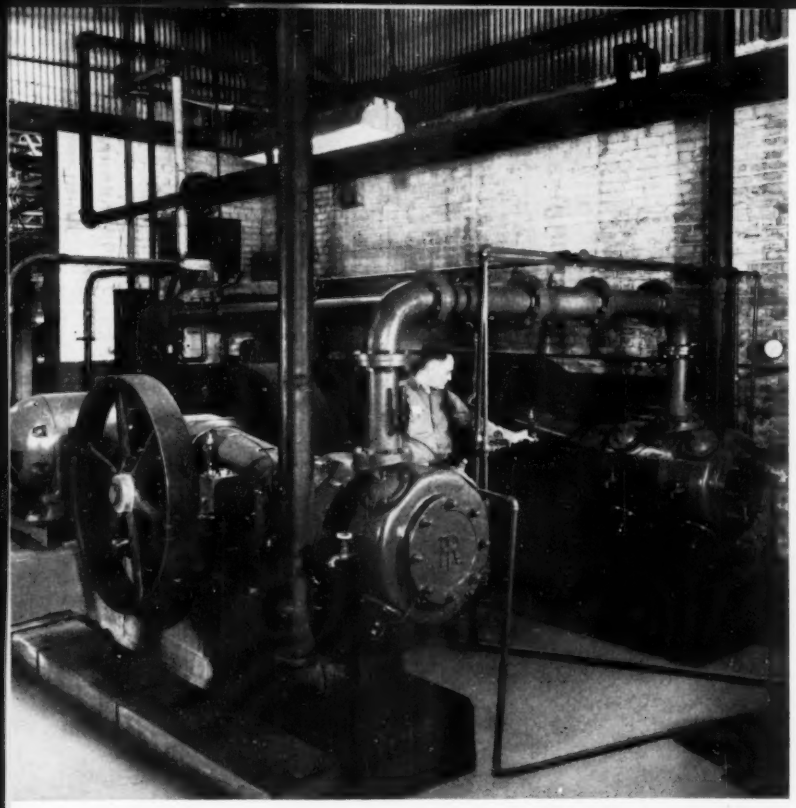


LEVER OPERATED—Pilot lever for connection by cable or mechanical linkage to floats or other devices. Slight actuator motion opens and closes main valve.

SE 116

SPENCE ENGINEERING COMPANY, INC.
WALDEN, NEW YORK

Spence



Send for this booklet...

See what Stanoil offers you...

You'll find the means to significant savings in this booklet. It describes the important qualities of STANOIL Industrial Oil and the resultant benefits which have made this multi-purpose oil the choice of midwest manufacturers for a host of important lubricating jobs. Discover how STANOIL will give you superior protection through its unique combination of six outstanding characteristics, including high stability and effective rust prevention. Find how STANOIL can simplify stock, storage, and inventory in your plant by replacing special-purpose oils in hydraulic systems, speed reducers, air compressors, machine tools, electric motors, auxiliary turbines, and a wide variety of circulating, bath, and bearing systems. Ask the Standard Oil lubrication specialist from your nearby Standard Oil office for this booklet, or write: Standard Oil Company (Indiana), 910 S. Michigan Ave., Chicago.

Compressors give carbon the air

• When carbon formed on the valves of these air compressors and the oil in the crankcases had to be changed frequently, operators of this Midwest plant called in a Standard Oil lubrication specialist. He recommended STANOIL Industrial Oil, a multi-purpose oil having a low carbon-forming tendency and containing effective oxidation and corrosion inhibitors. With STANOIL, the compressors gave the air to carbon troubles and have breezed through four years of hard operation without difficulty. Over the oil previously used, STANOIL has given four times longer service in the crankcases. These results . . . similar to the results you may expect . . . have led to the use of STANOIL in other equipment in this plant.

STANOIL
TRADE MARK
Industrial Oil

Find how this multi-purpose oil can benefit you by discussing it with a Standard lubrication specialist. You can contact him by phoning your local Standard Oil office.

Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

STANDARD OIL COMPANY (STANDARD) *(Indiana)*

Look at this "platform"... it proves why

DART UNIONS

are Elected by Acclamation!

"PLANK" NO. 1
Darts are precision-ground to a perfect sphere. The true ball joint gives a drop-tight fit quickly, easily without excessive wrenching.

"PLANK" NO. 2
Dart seats are bronze-to-bronze for maximum resistance to pitting and corrosion.

"PLANK" NO. 3
Dart threads are full and clean-cut, unlike threads of softer metal they won't deform or strip.

"PLANK" NO. 4
Dart body and nuts are made of high test air refined malleable iron for resisting stress and stretching. They're practically indestructible!

"PLANK" NO. 5
Darts can be used over and over again and *are!*

That's why once you "elect" Darts
You'll vote for them over and over again.

DART UNION COMPANY
Providence 5, Rhode Island
The Fairbanks Co. — Distributors
Boston New York Pittsburgh

DART
UNIONS

More EQUIPMENT NEWS

Begins on page 154

handling bulky loads such as sand, gravel, coal, ashes. Hopper can be tilted downward to scoop up loads or it can be loaded from overhead.

Yale & Towne Mfg Co, Philadelphia 15, Pa.

For more data on these items, use post cards, p 163. Identify request with P and number.

FEEDWATER SYSTEMS

P627 • Compact, flexible feedwater system for any type boiler is made from a 4-kit assembly. Originally designed for the manufacturer's *Steam-Pak* generators but found capable of handling any condensate return problem. The 4-kit assembly consists of one each for make-up, heater, receiver and pump phases. Any individual kit can be purchased separately. System reclaims both high- and low-pressure condensate, maintains a constant, uniform water temperature to effect a substantial fuel savings.

York-Shipley, Inc, York 4, Pa.

CHEMICAL PROPORTIONING PUMP

P612 • This pump is suited for boiler feedwater treatment where capacities do not exceed 12 gph or pressures 300 psi. Small laundries, dry cleaning and bottling plants are some places where it is useful. Prime feature is interchangeable pump heads. Any simplex pump can be converted into a duplex. Dual operation is also possible. Model 100 has a ¼-hp motor that drives pump at 70 strokes per min through a gear reducer. Unit weight is 62 lb, including motor.

Neptune Pump Mfg Co, 4912 N 6th St, Phila. 20, Pa.

DUCT INSULATION

P610 • *Fiberglas* vapor-seal duct insulation is designed to stop condensation on air-conditioning ducts that carry cool air in warm, humid areas. It is applied in a single operation. Efficiency is good. Insulation is furnished in 24x48-in. panels in thicknesses of ¾, 1, 1½ and 2 in. It is easily cut to any shape and may be painted, plastered over or covered with canvas.

Owens-Corning Fiberglas Corp, Toledo 1, Ohio

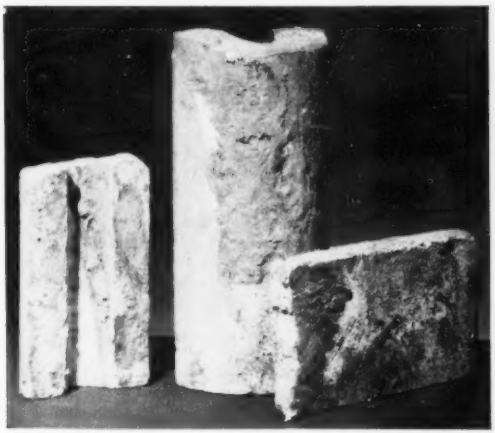
PROPELLER FAN

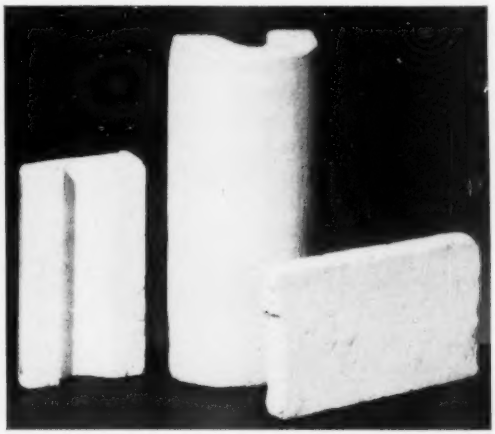
P613 • Heavy-duty belt-driven fan is adapted to industrial applications, ductwork, filtering and other units where large volume of air is needed under static pressure. Propeller is cast aluminum, airfoil type. Sizes range from 24 to 48 in., capacities from 5000 to 28,000 cfm.

Chelsea Fan & Blower Co, Inc, 639 South Ave, Plainfield, N. J.

CAUGHT IN A FLOOD

...Dug Out of the Mud, Kaylo Heat Insulation Proved Still Usable!





WATER SOAKED AND CAKED WITH MUD, these three pieces of Kaylo Heat Insulation were found partially buried in the Kansas City, Missouri, warehouse of Procter & Gamble after nearly two weeks of Missouri River flood water had receded. The unretouched photograph above shows the wet and mud covered pieces as they looked on arrival at the laboratories in Toledo, Ohio after shipment in a loosely-packed carton.

THE SAME THREE PIECES are shown in this unretouched photograph after they were cleaned by holding them under a water faucet and rubbing by hand, then dried with an electric fan. These pieces are still usable—*proof* of Kaylo Heat Insulation's resistance to water damage. Other Kaylo Heat Insulation, already installed at this plant, was under water during the flood, yet is still in place and performing efficiently.

Kaylo Heat Insulation is a hydrous calcium silicate — the heat-saving material that is revolutionizing insulation practice with its outstanding combination of advantages.

WRITE FOR FREE BOOK—"Kaylo Heat Insulation." Address: Dept. N-275, Owens-Illinois Glass Company, Kaylo Div., Toledo 1, Ohio.

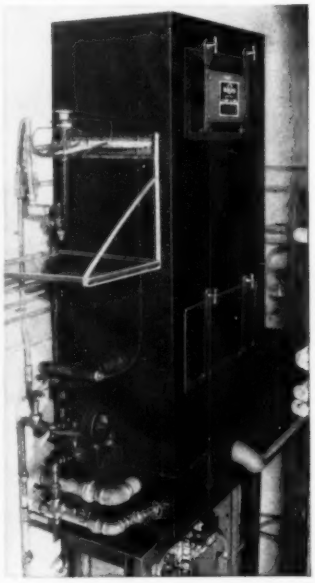
KAYLO® ... *first in calcium silicate*

...*pioneered by* OWENS-ILLINOIS Glass Company

MAIN OFFICE: TOLEDO 1, OHIO — KAYLO SALES OFFICES: ATLANTA • BOSTON • CHICAGO • CINCINNATI • CLEVELAND • DETROIT
HOUSTON • MINNEAPOLIS • NEW YORK • OKLAHOMA CITY • PHILADELPHIA • PITTSBURGH • ST. LOUIS • WASHINGTON

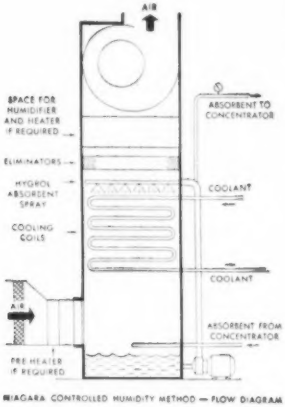
New "Controlled Humidity" Method Gives a Better Solution to Air Conditioning Problems

"Hygrol" Absorbent Liquid Dehumidifies Fresh Air Without Refrigeration



NIAGARA Air Conditioners or Dehumidifiers using "Hygrol" liquid absorbent give precise control of air temperature and humidity... at lower operating cost, with large savings in space and with smaller and less expensive equipment, in many applications.

This method dehumidifies the air by passing it through a chamber in which "Hygrol" spray removes its moisture and produces a low dew point. The "Hygrol" solution resulting is continuously and automatically re-concentrated, providing always full capacity in air conditioning and assuring always a constant dehumidifying capacity and a trustworthy, constant condition for your material, apparatus, process or room to be conditioned.



NIAGARA CONTROLLED HUMIDITY METHOD — FLOW DIAGRAM

"Hygrol" is a liquid, not a salt solution; it stays pure and non-corrosive; it does not cause maintenance or operating troubles in food plants or in chemical processes.

Investigate this new Niagara Method for "comfort" air conditioning as well as to protect quality in hygroscopic material, or processes or instruments, or to prevent condensation damage to metals, parts or products.

Write for Specific Information

NIAGARA BLOWER COMPANY

Over 35 Years Service in Industrial Air Engineering

Dept. P, 405 Lexington Ave. New York 17, N. Y.

"Experienced District Engineers in all Principal Cities of U.S. and Canada"

More POWER NEWS

Begins on page 148

which have yielded as much as three hundred pounds per acre per year—a supply for a family.

"Next, we'll see the development of chemical soil conditioners.

"These are not fertilizers, but they may be equally important in agriculture. They are chemicals that bond clay soils in a beneficial manner to give it good 'tilth.' Added to soil in small quantities, about a pound to the ton of soil, they facilitate water penetration and increase water-holding capacity. They allow air to enter for growth of aerobic microorganisms and for root development. They improve root penetration, and allow seedlings to extend through the surface readily. They increase the availability of mineral nutrients and thus conserve fertilizer. With all other conditions unaltered, tests with them have resulted in from 20 to 80% increase of crop under typical conditions. This is a revolution in agriculture in the making, and no man can yet say how far it will extend. Much depends upon ultimate costs, but there seems to be no inherent reason why the new materials should be unduly expensive."

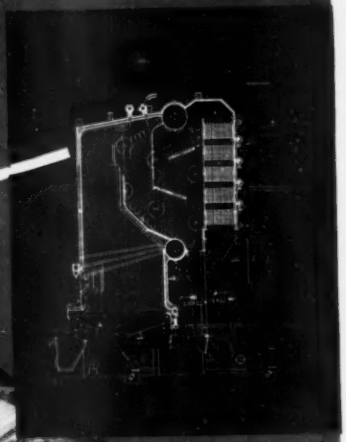
Sweden Puts 130,000-Hp Hydro Units in Service

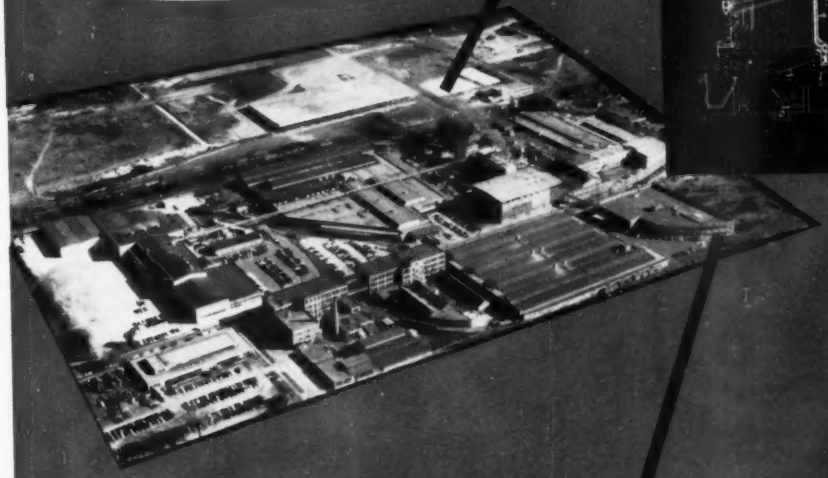
The Swedish Royal Board of Water Falls has put three units in operation in the Harspranget hydroelectric plant on the Lule River, 22 miles north of the Arctic Circle. They are each rated 130,000 hp, 166.7 rpm under 336-ft head. Their runners are about 11 ft in diameter and operate in plate-steel scroll cases. These are by far the highest powered hydroelectric turbines in Europe and are exceeded in capacity only by the eighteen 170,000-hp units in the Grand Coulee plant on the Columbia River in the United States.

Power from the 100,000 kw generators driven by the turbines is transmitted at 380,000 v through central Sweden 600 miles to Hallsberg. This is probably the longest transmission line in the world and operates at the highest voltage. Other transmission lines are being built in other parts of the world for comparable voltages. At Hallsberg, voltage is stepped down to 200,000 and connected into the Royal Board of Water Falls power-transmission network.

The Harspranget Falls plant is the most important source of water power in Sweden and the plant the largest in that country. With three units installed it will generate 1.8-billion kwhr annually, but this may be increased by installing a fourth unit. Like many of Sweden's hydro plants, Harspranget has been blasted from solid rock and is about 225 ft underground. This construction provides protection against air attacks and the plant operates at practically constant temperature, even in the extremes of summer and winter.

SUTHERLAND PAPER COMPANY Installs 12th WICKES STEAM GENERATOR





The new WICKES boiler in SUTHERLAND'S Michigan plant produces 120,000 lbs. steam per hour at 475 lbs. pressure and final steam temperature of 650° F.

Like so many industries and institutions that require steam, the SUTHERLAND PAPER COMPANY with plants in Kalamazoo, Michigan, and Santa Clara, California, has learned to depend on WICKES for efficient steam production. That's why they've just installed their twelfth WICKES boiler in 35 years of successful paperboard manufacture. The new WICKES boiler at the SUTHERLAND PAPER COMPANY is fired by spreader stoker but these units are readily adaptable to any standard method of firing. It is equipped with a superheater and an economizer and the design makes it especially practical where space is limited. WICKES can fill your needs for steam generators up to 250,000 lbs. per hour and 1000 psi. Write today for descriptive literature or consult your nearest WICKES representative.

WICKES

136

THE WICKES BOILER CO., SAGINAW, MICHIGAN • DIVISION OF THE WICKES CORPORATION

RECOGNIZED QUALITY SINCE 1884 • SALES OFFICES: Atlanta • Boston • Buffalo • Chicago • Cincinnati • Cleveland • Denver • Detroit • Greensboro, N.C. • Houston • Indianapolis • Los Angeles • Memphis • Milwaukee • New York City • Pittsburgh • Portland, Ore. • Saginaw • San Francisco • Springfield, Ill. • Tampa, Fla. • Tulsa • Washington, D.C.

ROTOJET®
TUBE CLEANERS

Give More Power
Use Less Air

More power with less air for a faster, more thorough tube cleaning job—that's what the new Rotojet offers. A Rotojet should save you enough in time, labor, and air on one cleanout to pay for itself. Send for Bulletin R-105 for full details.

THE SECRET

ROTOJET Motor has only two moving parts, a shaft and a paddle. Positive contact between paddle and Rotocentric (egg-shape) bore cylinder prevents stalling at low speeds. No leakage. Delivers maximum power for air used.

ELLIOTT COMPANY-ROTO DIVISION
153 Sussex Avenue Newark 1, N. J.

BOOKSHELF

Performance of Lubricating Oils. *By H H Zuidema, Shell Oil Co. 179 pp, 6x9 in., $5. Reinhold Publishing Corp, 330 W 42nd St, New York 36, N. Y.*

Lube oil performance is stressed rather than specific applications. Therefore oxidation, bearing corrosion, etc, take the limelight instead of aircraft oils, motor oils, etc. The author takes this course since performance characteristics are of a more basic nature than properties of an oil for specific use.

In addition to general lubrication requirements he discusses such matters as the lubrication process, flow characteristics, sludge and lacquer deposition, emulsification and foaming. Ample reference is made to viscosity, pour point and extreme pressure lubrication.

This book will make a fitting contribution to those concerned with the development, manufacture and use of lubricating oils.

Fluid Flow in Pipes *(1952). By Clifford H McClain, industrial consultant, 128 pp, 6¼x9¼ in., 18 illust, 9 tables, fabrikoid, $3. The Industrial Press, 148 Lafayette St, New York 13, N. Y.*

This is a good introduction or refresher covering mechanics and dimensions of gas and liquid flow in pipes and ducts. Fundamental physical processes are explained in simple language and dimensions used in various systems of calculation are clarified.

Properties of fluids affecting flow are discussed with illustrations of the overall influence of each. Friction and energy balance problems involving turbulence and streamline flow are solved with emphasis upon consistency in evaluating factors like Reynolds number. Empirical formulas presented for flow calculations are discussed from the aspect of their physical basis.

Engineers and others who encounter only an occasional problem in fluid flow will find particular value in the straightforward tracing of consistent dimensional units through the calculations.

Alternating-Current Machines. *By George V Mueller, Professor of Electrical Engineering, Purdue University. 6x9 in., 502 pp, $7.50. McGraw-Hill Book Co, 330 W 42nd St, New York 36, N. Y.*

Here is the first edition of a new text in ac. It is intended primarily for use by senior electrical engineering students. An unusual number of problems and oscillograms are included to illustrate principles analytically and graphically.

The text presents an analysis of operating characteristics and construction of transformers, synchronous machines, single phase motors and rectifiers. Standard abbreviations and symbols are used throughout.

Past Examinations for Professional Engineers, New York State. *By John D Constance, professional engineer, 35 pp, 8⅜ x 11⅛ in. paper, $1. Published by John*

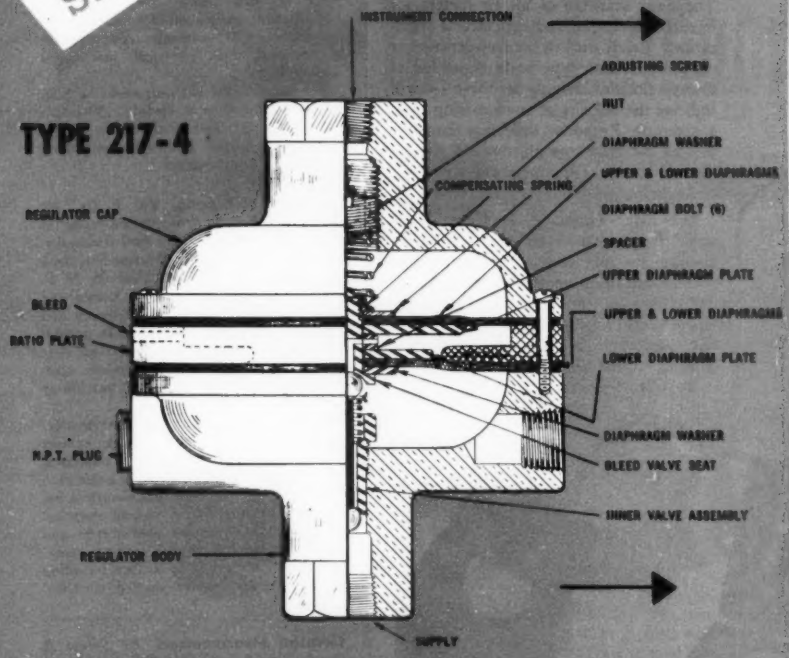
STEP-UP

SPEED-UP

SLOW-UP

VALVE ACTION *with* BS&B CLIMAX RELAYS

TYPE 217-4



For almost any pressure, input or output variation in the supply medium to the control valve, there's a Climax Relay to do the job efficiently and accurately. You can deliver pressure output to step up action, boost the capacity of low-limit controls to handle larger loads, speed the valve loading or reduce it, eliminate pressure lag on long supply medium lines, control high steam pressures with balanced diaphragm regulators.

New BS&B Climax Relays are being constantly developed to meet the demands of the latest methods and equipment. Their accuracy and sensitivity will contribute much to the efficiency of your processing system. They will, in many cases, provide a great economy by permitting your valves and controls to expand their designed functions.

Write for Catalog Section 109—"Relay Regulators," Illustrated, complete with descriptions, application and installation data.

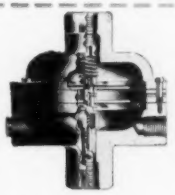
CLIMAX BS&B CONTROLS

BLACK, SIVALLS & BRYSON, INC.

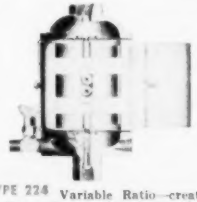
Climax Controls Division Dept. 4Q8

7500 East 12th St. Kansas City 3, Missouri

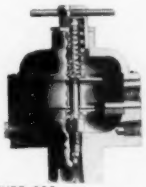
NEW TYPE 227 Delayed action, fixed ratio. Permits full valve travel with standard diaphragm pressure ranges on series-operating diaphragm control valves in combination with type 217-2B relay.



TYPE 217 Fixed Ratio—to meet demands of control pressures beyond the range of usual instrument pressures; permits low-limit controls to secure higher loading pressure.



TYPE 224 Variable Ratio—creates a loading of pressure balanced diaphragm valves to permit the control of high steam pressures in reboilers or fractionating kettles, where steam pressures must vary for varying products.



NEW TYPE 228 Reverse Action Relay for maximum pressure output at minimum input—or vice versa. Or, in by-pass installation, reverse valve action in relation to pilot action, when occasionally required.

TYPE 209 1 to 1 Ratio—will eliminate air exhaust and input pressure lag where long supply medium lines are used.

MEASURE AIR VELOCITY DIRECTLY AND ACCURATELY

WITH A

HASTINGS AIR-METER

Hastings Model H Air Meter. Compact unit for field and laboratory use. Velocity Ranges: 10-750 fpm; 750-5500 fpm.

The most sensitive of all air meters for research, industrial and agricultural applications. Reads directly in feet-per-minute on a logarithmic-type scale expanded at lower velocities. Highly sensitive — will indicate the velocity of smoke rising from a cigarette. Response time less than one second. Accurate to within ± 2% regardless of ambient temperature or static pressure.

Uses the exclusive Hastings noble metal thermopile in an extremely stable circuit. Instantaneous range switching without recalibration. Probes available for directional or non-directional reading. Easily adapted for remote recording since the calibration is independent of lead length. Available in several models to meet your specific requirements.

Hastings Model G Air-Meter. Small hand type instrument. Velocity range: 0-6000 fpm; Weight: 26 ounces.

Hastings Model B Air Meter for measurements of greatest precision. Velocity ranges: 0-400 fpm; 400 to 6,000 fpm. Meter type continuous calibration check. Knife edge, parallax free indicator.

Write for descriptive literature and prices on Hastings Air Meter, Manometer and Flowmeters, and Vacuum Gauges.

HASTINGS INSTRUMENT COMPANY, INC.

HAMPTON, 37 VIRGINIA

DESIGNERS AND BUILDERS OF RAYDIST AND SPECIAL ELECTRONIC, ELECTRICAL, AND MECHANICAL INSTRUMENTS

More BOOKSHELF

Begins on page 188

D Constance, 625 Hudson Terrace, Cliffside Park, N. J.

A compilation of past examinations of the University of the State of New York from January 1943 through June of 1951 by the instructor of several professional-engineering - license - preparedness courses. This compilation is divided into three parts: (1) structural planning and design (2) practical application of basic engineering sciences (3) economics and practices in chemical, civil, electrical, mechanical engineering.

The value to the engineer readying himself for examination is obvious. With this compilation the nature and form of the examination is made known and something of its breadth of coverage.

Electrical Engineering, Vol 1, Dc. *By Chester L Dawes, Associate Professor of Electrical Engineering, Harvard University. 9½x6½ in., 736 pp, $7. McGraw-Hill Book Co, 330 W 42nd St, New York 36, N. Y.*

This new edition of a well known and widely used text wraps up dc theory and some practice in the one book. In general it covers electric circuits, batteries, electrical instruments and measurements, magnetism, electrostatics, electric machinery and dc power transmission.

Emphasis throughout is on mathematical and theoretical treatment. Each subject developed is illustrated with a numerical example. And to drive the point home each example is tied in to actual electrical apparatus. Construction of modern electrical machinery is shown by photographs and drawings supplied by the leading manufacturers. The text is up to date including recent developments in applied electrical science.

Electrical Measurements. *By Forest K Harris, Physicist, National Bureau of Standards, 784 pp, 6x9½ in., $8. John Wiley & Sons, Inc, 440 Fourth Ave, New York 16, N. Y.*

This book stems from a course of lectures on electrical measurements given at George Washington University. It is a most complete work, covering all necessary material from basic principles to applications within the field of dc and low-frequency.

Author discusses the origins, relations, and dimensions of electrical units. He then systematically presents basic instrument theory starting with the galvanometer. From there he delves into indicating instruments, dc ammeters and voltmeters, potentiometers, wave form and frequency measurements and finally ac bridges. The book includes much material that is appearing in print for the first time.

Glenn B Warren, general manager of the turbine division at **General Electric Co,** was among eight nationally-known engineers and industrialists to be cited for outstanding accomplishments in their fields at the fourth annual University of Wisconsin Engineers' Day on May 2.

NEW Weather-Protected Motor FOR Tough Outdoor Drives

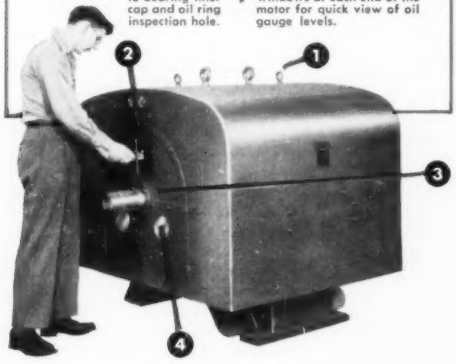
THIS IS HOW EASY "ACCESS" CAN BE

1 Lift steel protective hood easily by lifting eyes for periodic cleaning of motor.

2 Open knurled fastening locks quickly. Take door plate off for handy access to bearing filler cap and oil ring inspection hole.

3 Remove large plates to get at ends of the motor for bearing inspection or removal, air-gap measurement or blow-out of interior.

4 Look through plexi-glass windows at each end of the motor for quick view of oil gauge levels.



Look at this new E-M Weather-Protected Induction Motor, equipped with its own roof! You can set it up anywhere for exposed drive duty on pumps, draft fans, etc. Even with protection which holds off the weather's worst, access is simple and quick without dismantling the motor.

This new E-M "toughy" gets plenty of clean ventilating air, too. Intake air enters above motor feet at low velocity, is further slowed so that suspended particles are dropped before the rotor is reached. Special "blow-through" passages provide a by-pass for high velocity gusts of wind. Screens on all openings prevent entrance of refuse. Intake air filters are available.

E-M paints metal surfaces of the motor with liquid stainless steel paint for greatest protection against corrosion. Internal parts are specially processed for maximum moisture resistance.

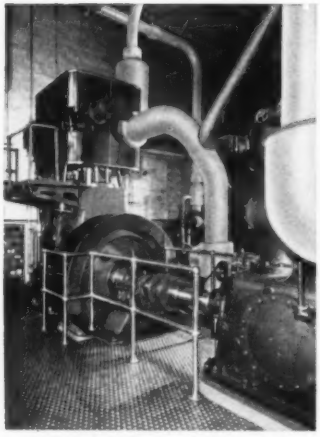
Next time you decide to take a drive outdoors, call your nearest E-M sales engineer. He'll be glad to tell you more about this new Weather-Protected Motor. And write the factory for information on it right now.

ELECTRIC MACHINERY MFG. COMPANY
MINNEAPOLIS 13, MINNESOTA

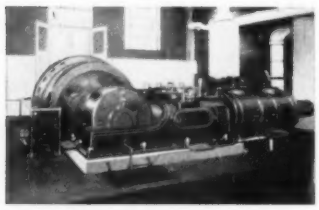
BUILDERS OF THE BEST IN BIG MOTORS

1300-TPA-2123

ALL TYPES OF INDUSTRIES
Generate Power and Save Money with
SKINNER
"UNIVERSAL UNAFLOW"
STEAM ENGINES



Two-cylinder "Universal Unaflow" driving ammonia compressor, in Brewery Power Plant.



300-Kilowatt Horizontal "Universal Unaflow" in Meat Packing Plant.

RUN down the list of American industries which are depending on Skinner Engines for unfailing, dependable power . . . to generate electricity . . . to drive compressors and pumps . . . for refrigeration and air conditioning. They have low-pressure steam as a by-product, for space heating and for use in varied manufacturing processes.

This list includes Agricultural Implement Manufacturers, Chemical Plants, Cotton Oil Producers, Electrical Appliance Manufacturers, Forging Plants, Foundries, Gas Companies, Glass Manufacturers, Machine Tool Builders, Oil Refineries, Potteries, Rubber Manufacturers, Steel Companies, Textile Mills, and Woodworking and Furniture Plants.

Among these and many other classes of money-saving users of Skinner "Universal Unaflow" Steam Engines are some who had power problems similar to yours . . . and solved them with a Skinner installation.

Write for literature and data regarding what has been accomplished under your conditions.

For Over 80 Years, Doing One Thing Well—Building Steam Engines
SKINNER ENGINE COMPANY, ERIE, PA.

More TECHNICAL BRIEFS

Begins on page 150

of 10 distinctly different basic types.

All determinations were made in the operating process areas of three major chemical manufacturing plants. These were widely divergent geographically, had 14 different environments. Wire brushed, corroded and blasted surfaces were examined. No artificial or simulated exposures were used.

To obtain comparisons, and to determine performance over surface irregularities normally encountered in maintenance painting, a new type test panel was used. Reliability of test-panel results was confirmed by 101 individual paint applications to operating equipment and structures. Actual and projected useful life expectancies of various painting systems and procedures were determined, and converted to direct dollar cost and savings. Some of the results given are: (1) Over 60% of the industrial maintenance paint compositions that have long proved adequate in straight industrial use will fail rapidly in a chem-industrial exposure. (2) Surface preparation by blasting will increase protective life by two to four times over wire brushed or corroded surfaces. (3) Thicknesses below 5 mils are undependable in aggressive chem-industrial environments. (4) Regular schedules of paint inspection and repair can reduce cost of plant protection to 5c per sq ft per yr even in aggressive chem-industrial exposures. *NACE paper. No. 14.*

Directions for ordering papers on p 152

Metallizing Economics in Modern Industry. *By R J McWaters, and A P Shepard, Metallizing Engrg Co.*

Establishing an abrasion- and environment-resistant metal interface is often possible only by using heavy noble metal coatings. In some cases, these coatings can serve without using additional organic coatings as sealers. In other environments, organic coatings must be used to seal the porosity pattern. The surface preparation finish before metallizing must often have high uniformity and anchor level. The paper outlines in detail the economic advantages of metallizing and also gives an introduction to modern metallizing equipment. *NACE paper. No. 25.*

Electrical Measurements Applied to Corrosion Investigation. *By W R Schneider, Pacific Gas and Electric Co, and David Hendrickson, East Bay Municipal Utility District, Oakland, Calif.*

Some sections of pipe line may be subject to severe corrosion in soils of low

MITCHELL

PIPING SINCE 1899

Nothing gives one a grasp of the down-to-earth realities like experience. That's why our more than fifty years in the power piping field are significant for you . . . and why you can depend on us to handle your next project smoothly and economically. Send us your drawings for an estimate — with no obligation.

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W. K. MITCHELL & CO., INC.
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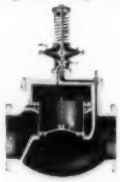
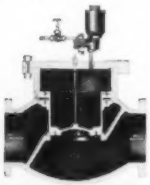
WE ARE INDEPENDENT PIPING FABRICATORS AND ERECTORS

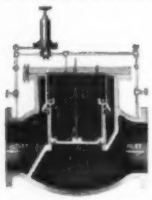
Immediate Shipment From Stock
On Many Sizes
GOLDEN-ANDERSON
Cushioned
Steam and Water Pressure Valves
One of these eight valves will ideally meet your requirements

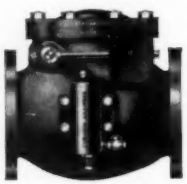
Single-Acting Non-Return Valve

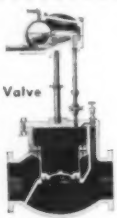

Altitude Control Valve


Solenoid Operated Electric Water Service Valve

Surge Relief Valve


Water Pressure Reducing Valve


Swing Check Valve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More TECHNICAL BRIEFS

Begins on page 150

resistivity, while other sections may be subject to only very mild or no corrosion in soils of high resistivity. The problem is to determine extent of corroding areas. If cathodic protection is required, proper tests must be made to determine when complete protection has been achieved. This information must be reliable, but the cost of obtaining it should be commensurate with the contribution to the economy. Some determinations on small pipe lines are relatively simple. But when the pipe is from 30 to 68 in. in diameter and much of it is under water, including river crossings, the investigation becomes more difficult.

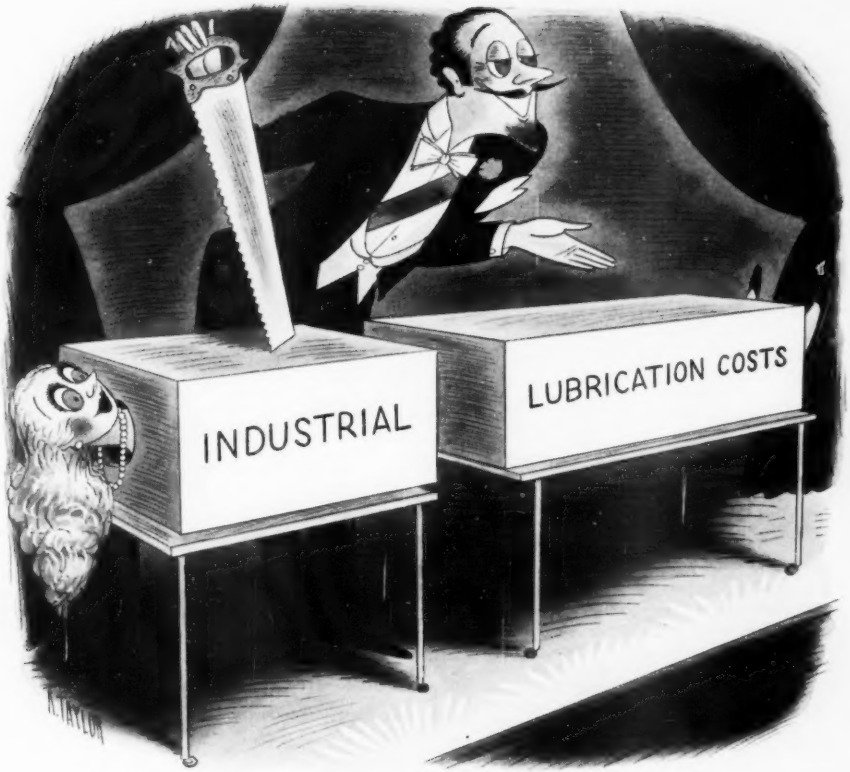
Surface potential surveys as described by O C Mudd and others sometimes are more economical than using the conventional earth current meter on large pipe lines. This is particularly true on river crossings where the ground surface is 35 feet below the water surface. As some river crossings cost over $1,000,000 each, it is very important that the structure be fully protected. This paper deals with electrical measurements used by Pacific Gas and Electric Co on its gas transmission lines from Arizona to Northern California. It includes the method of investigation used by East Bay Municipal Utility District on its large aqueducts that supply water to cities on the east of San Francisco Bay. Comments are made on erratic values obtained in pipe-to-soil potentials using the copper sulfate half cell. *NACE paper. No. 27.*

Directions for ordering papers on p 152

Cathodic Protection of Tank Bottoms. *By Scott P Ewing and J H Hutchison, Carter Oil Co.*

The problem in applying cathodic protection to tank bottoms is to determine when sufficient current reaches the central part of the bottom. It was found by measurements on models that current-potential curves or potential measurements in general are of no value, probably because the potential of the outer rim rather than the central part of the tank is measured. Current density on all parts of a tank bottom may be calculated for the case of uniform resistivity and no polarization. For this case the efficiency of current distribution is 50%. If the soil resistivity varies with depth the efficiency will vary.

The paper shows how efficiency of current distribution can be estimated by means of four terminal resistivity measurements, taken near the tank. This



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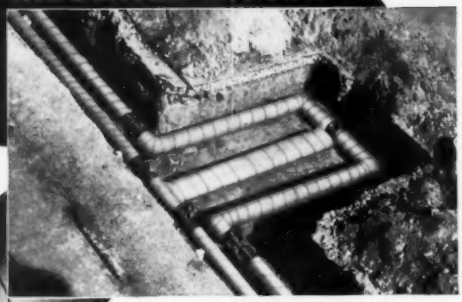

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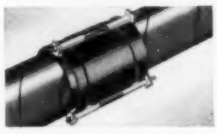

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More TECHNICAL BRIEFS

Begins on page 150

method has two limitations: (1) it assumes that the soil at the place of measurement is the same as that under the tank and (2) it does not take into consideration coatings or pads under the tank. Another modified four-terminal measurement, which uses the tank bottom as one terminal, measures the actual conditions under the tank. Knowing the current density required for protection this method should provide a needed tool for determining the effectiveness of pads and coatings and the current required to protect the center of the tank. The results presented in the paper were obtained mostly with models. The method needs further trials on actual tanks before it can be recommended for general use. *NACE paper. No. 28.*

Turbines and Controls

Controls of Steam Turbine Units. *By Charles F Wilson, Allis-Chalmers Mfg Co.*

The types of controls used on steam turbines can be divided into four general classifications: (1) controls for starting and stopping the machine (2) controls for governing and maintaining regulation (3) controls for turbine auxiliary equipment and (4) controls for safety and automatic protection of the turbine.

Most of the controls are hydraulically operated, using turbine oil at 150 psi as the operating medium. The author employs a control diagram to show all of the control devices schematically and how they connect into the turbine oil system. To more easily explain the operation, he separates the control diagram into its various component parts. *APC paper. No number.*

Directions for ordering on p 152

Efficiency and Design of High Temperature Reheat Turbines. *By J R Carlson, Westinghouse Electric Corp.*

This paper has two objectives: (1) To provide heat rates for large turbine generator units in Btu/kwhr in a simple, easily useful tabular or curve form. (2) To outline the developments in high-temperature turbine units.

Large turbine efficiencies used to be prepared in a form that involved straight condensing steam rates. Today the heat consumption of turbine generator units in Btu/kwhr is a better means of evaluating the economics of more advanced steam conditions and of various turbine ratings.

Recent natural grouping or semi-standardization of steam conditions and

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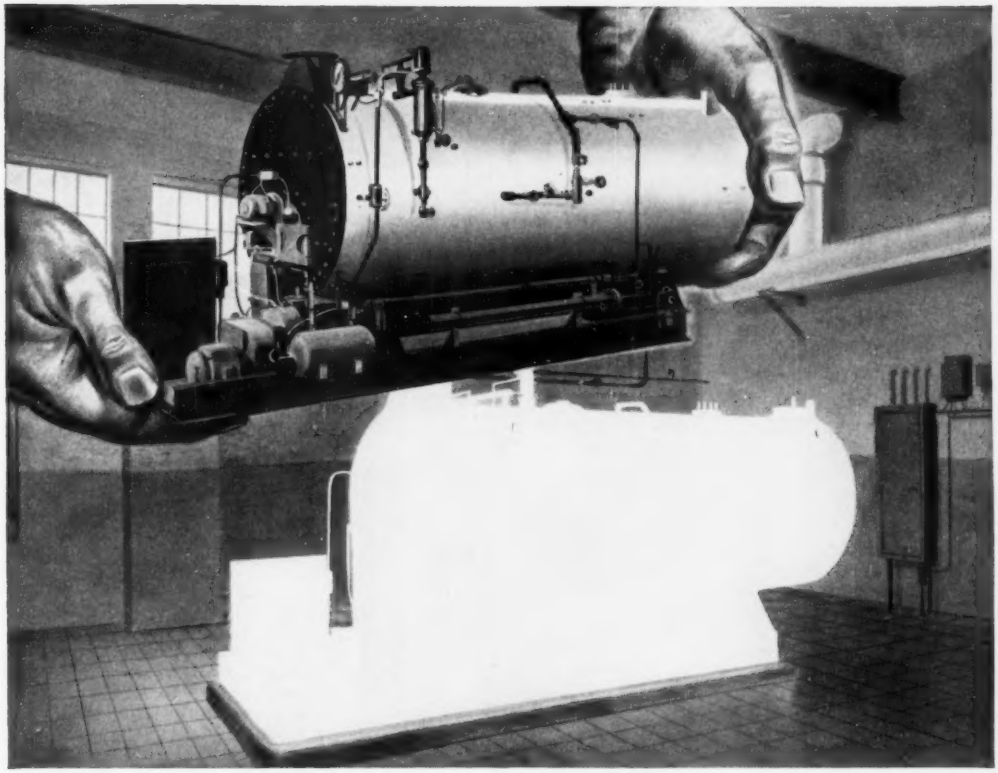

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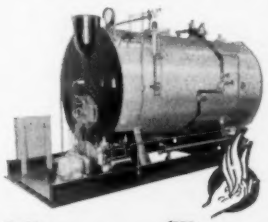

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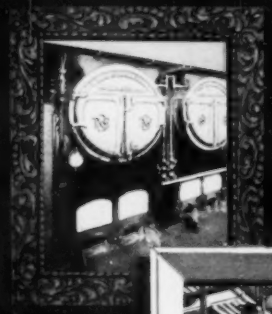

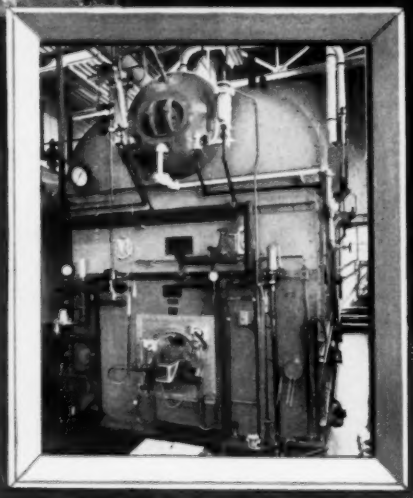

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More TECHNICAL BRIEFS

Begins on page 150

feed water heating arrangements has greatly simplified calculating and tabulating heat rates of large turbines.

Information published by the author's company on turbine generator units covers the expected heat rates at rated load for various numbers of heaters from 0 to 5, and for turbine generator ratings of 10,000 to 60,000 kw and steam conditions up to 1250 psig, 950 F. This data has been supplemented by other turbine manufacturers. They provide heat rate information on the preferred standard AIEE/ASME turbine generator units at part and full loads and for different exhaust pressures. *APC Paper. No number.*

Directions for ordering on p 152

Servomechanisms in the Power Industry. *By M A Edwards, General Electric Co.*

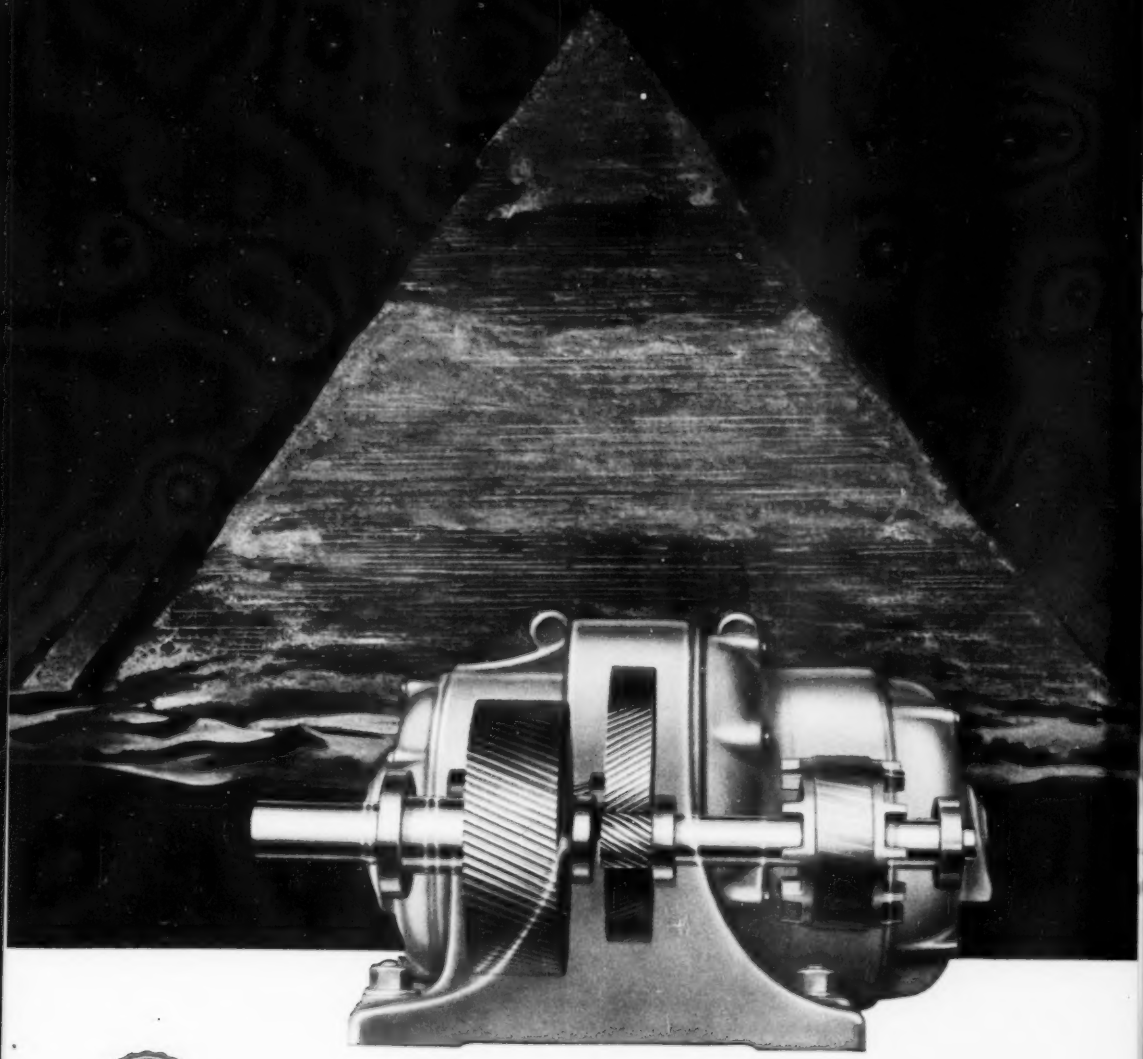
Increased use of power has brought complex problems of control—particularly automatic control. One device that helps solve these problems is the servomechanism. Broadly speaking it is a control system in which an output is compared to a reference and the difference (error) is applied in a manner to bring the output into correspondence with the reference. Some are relatively simple like the familiar thermostat control system of an oil burning furnace. Others are tremendously complicated.

Essentially all servomechanisms consist of four elements: (1) a reference, (2) an error-measuring means, (3) an amplifier, and (4) an actuator. The amplifier may be called the heart of the system. The signal originating in the error-measuring device is almost always of small amplitude, while the power requirements of the actuating device are likely to be relatively large. The amplifier must bridge this gap, and it must do it with great accuracy, speed and reliability.

There are four general methods of securing amplification in a servomechism: (1) hydraulic (2) rotating machine (3) electronic tube and (4) magnetic amplifier. *APC paper. No number.*

Establishment of a new **National Bureau of Standards** laboratory center at Corona, Calif., to be devoted to various phases of electronic research, development, and engineering was announced by Dr E U Condon, director of NBS. To be known as the Corona Laboratories, NBS, the new research center will be primarily concerned with technical problems of importance to the Department of Defense.

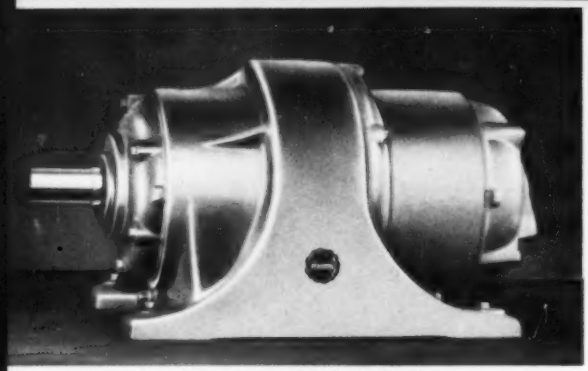
DURABILITY



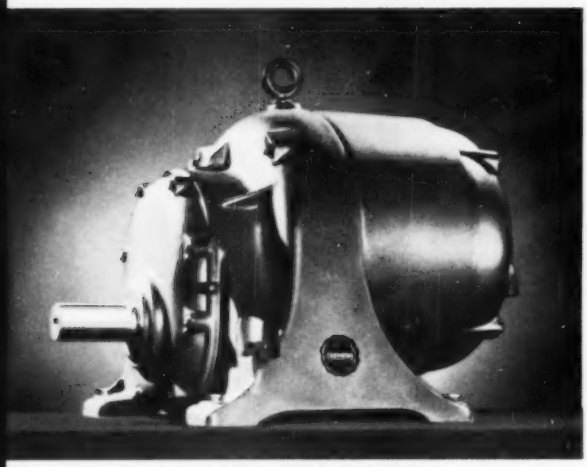
U.S. MOTORS

U. S. SYNCROGEAR MOTOR

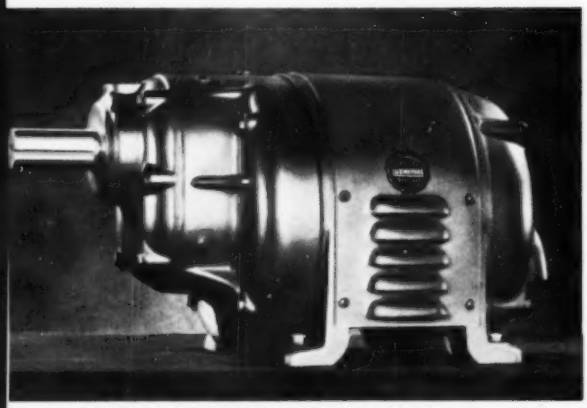
The internally-geared motor with **PYRAMIDAL** *stability*



Type GD – U. S. Syncrogear Motor, Double Reduction



Type GR – U. S. Syncrogear Motor, Single Reduction



Type GH – U. S. Syncrogear Motor, Single Reduction and Speed Increaser

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WITH

SYNCROGEAR

THE INTERNALLY-GEARED MOTOR

When you need geared power for slow speeds or heavy loads, use this simple hook-up—the *U. S. Syncrogear Motor.* Instead of installing a motor plus gear box or exposed gears, extra coupling and belting, you can direct connect this motor.

The Syncrogear motor is internally-geared within a pyramidal structure which is extremely rigid. Gearing is maintained in perfect alignment and completely enclosed within a sealed housing, protected from dust, dirt and other contaminants. All castings are normalized. The motor windings are asbestos-protected to resist carbonization. The gears are hardened to Rockwell C 45/50 to insure longest life. Dip-splash lubrication automatically feeds the correct amount of lubricant and insures cool gear operation regardless of load.

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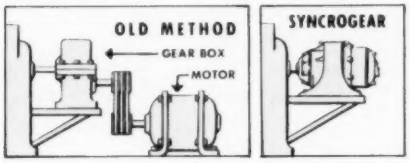

Note the compact setting of the U. S. Syncrogear Motor. It occupies practically no more space than a standard motor. Its integral design saves space so that equipment designers can reduce over-all dimensions and eliminate extra gearing and intermediate connections.

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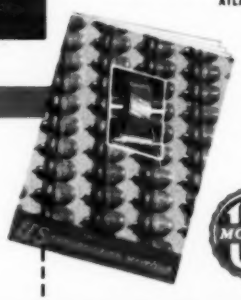

Atlanta 3, Ga.; Bakersfield, Calif.; Boston 16, Mass.; Chicago 8, Ill.; Cincinnati 16, Ohio; Cleveland 14, Ohio; Dallas 9, Texas; Detroit 2, Mich.; Fresno 1, Calif.; Houston 4, Texas; Indianapolis 4, Ind.; Milwaukee 2, Wisc.; Minneapolis 2, Minn.; New York City 6, N. Y.; Philadelphia 2, Pa.; Pittsburgh 2, Pa.; San Francisco 7, Calif.; Seattle 4, Wash. Sales and Service offices in all principal cities.

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Because our manufacturing personnel and equipment are all under the roof of one great plant—our complete know-how, experience, and facilities are constantly available on every job.

This is another reason why you can depend upon Pittsburgh Piping and Equipment Company for service that provides greatest safety, highest efficiency, and longest life from high temperature, high pressure piping.

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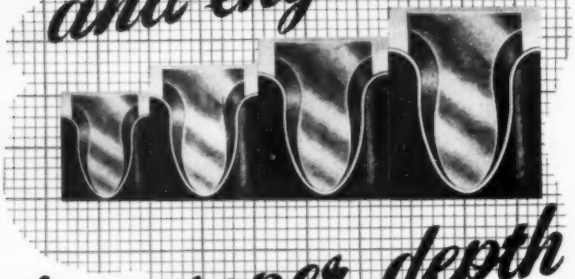
Designed and engineered for proper depth of corrugation



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Experience has proven that longer expansion joint life can only be safely assured by varying the depth of corrugation with relation to size and traverse per corrugation. In the regular practice of precision manufacture and engineering Badger Manufacturing Company has established standards for different diameters. *Not just a shallow and a deep corrugation, but precisely the accurate depth of corrugation needed.* Just one of the many important characteristics and reasons you should specify Badger Expansion Joints.

D-F S-E Directed-Flexing Self-Equalizing: an exclusive feature of Badger Expansion Joints. The flexing of the corrugations is progressively directed over each segment of each of the all-curve corrugations by correspondingly shaped self-equalizing rings. Localized stresses are eliminated insuring a more flexible longer lasting joint.

Buy Badger Joints and you get flexibility. D-F S-E and these features:

- Packless . . . pressure-tight single-tube — requires no maintenance
- Compact . . . approximately the size of flanged fitting
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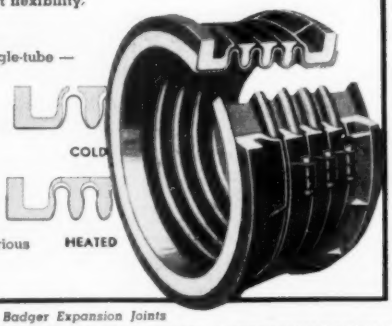
- Wide range of traverse — pressure — temperature

Fabricated from deoxidized copper, stainless steel and special alloys to meet various operating conditions.



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MARMADUKE

Continued from page 142

Her air receiver was piped down to the quarry for the air drills.

"Two Worthington duplex feed pumps were hooked up for taking water from a shallow pond a few hundred feet away. These pumps also supplied cooling water for the air compressors.

"Besides the fireman, I had an 'assistant' who was kept busy running a steam hoisting engine outside the powerhouse. He was supposed to make all the repairs. Trouble was he had only been at the quarry a few months and this was his first power-plant job.

"The powerhouse had a dirt floor of hard clay. It broke out raining that first morning. The roof leaked like a sieve, so before long the dirt floor was a mass of mud puddles.

"A few hours later, I was in back of the boilers trying to dope out a piping hookup that violated every code I had ever heard of. All of a sudden, the fireman came on the double and yelled he'd have to shut down.

"'What's wrong?' I asked.

"'Day ain't no watta in dem boilers,' he answered.

"I looked at the gages. The water was out of sight in two of them. Then I heard the feed pump running away. I started the standby, but it acted the same way. About that time the air compressor's cylinder started smoking. You could smell paint burning. I shut her and everything else down in a hurry by closing the boiler's main stops. That kept the water in the boilers. I then turned to, and helped haul the fires quickly.

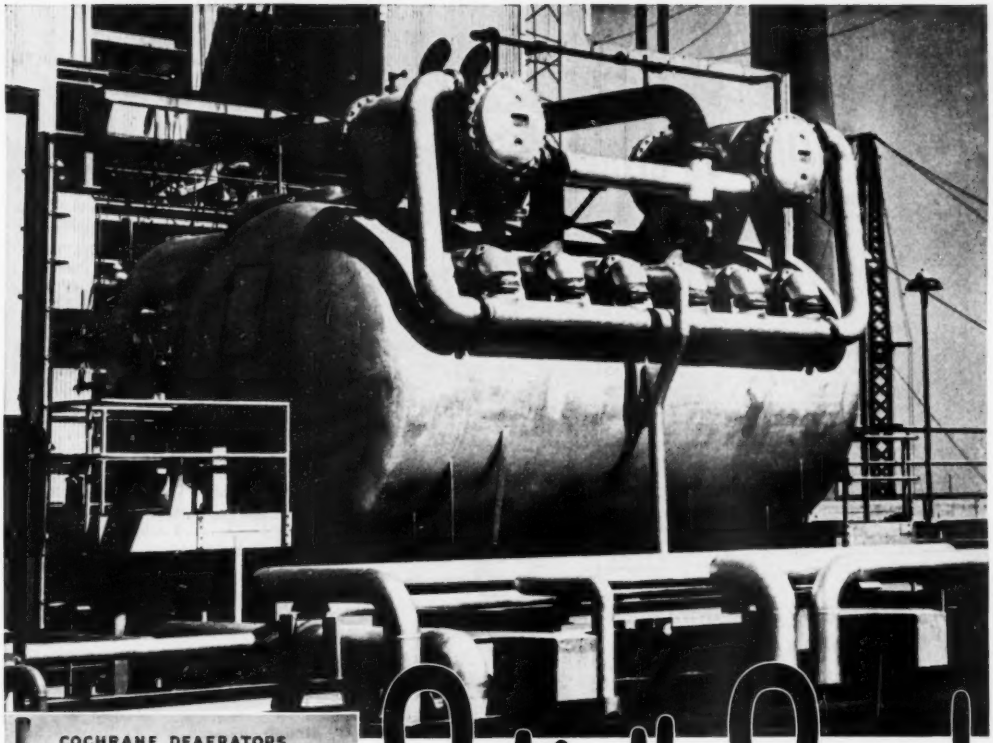
"With everything shut down, the quarry laborers started streaming into the plant.

"'No use gettin' into a frazzle,' said the fireman calmly, as I got after those feed pumps. 'Dis happens all da time. Dat watta line to da frog pond am prob'ly plugged agin.'

"The line was 3-in. diameter, flanged together every few feet. The laborers started taking the line apart without being told. This was evidently old stuff to them.

"'Jes send for dat powder monkey,' said the fireman. 'He know what t'do.'

"The powder monkey was a dried-up shrimp of an old man, with a long white beard. He set to work in a businesslike way and planted a few sticks of dynamite in the water near the feed line's suction where it dipped into the pond. When he set that blast off, frogs, fish and mud rained all over the place. While this was going on, I opened the valve-chest cover on the feed pump's liquid end. She was plugged almost solid with



Out in the Open!

AT PACIFIC GAS & ELECTRIC COMPANY'S new Contra Costa steam plant at Antioch, California, three COCHRANE DEAERATORS deaerate the boiler feed for six 475,000 lbs./hr. boilers.

Cochrane Deaerators at P. G. & E.'s Contra Costa Plant

THE DEAERATORS are of the Cochrane direct contact tray type with 1,176,870 lbs./hr. maximum flow, and 6300 gal. storage capacity. Each deaerator has two vent condensers and all three deaerators are mounted on the auxiliary bay roof, as shown in the large photo above and in the inset panel. In the heating cycle, the Cochrane Deaerators function after the No. 5 closed heater at a designed operating pressure of 5 psig.

These deaerators are three of the fifteen Cochrane Deaerators purchased by P. G. and E., installed or now on order. COCHRANE DEAERATORS whether tray-type, atomizing type or multi-stage type, are available for any deaerating need, for any size plant and for any location or space requirement. Cochrane Publication No. 3005 will be gladly mailed on request. Specific problems are also welcomed.

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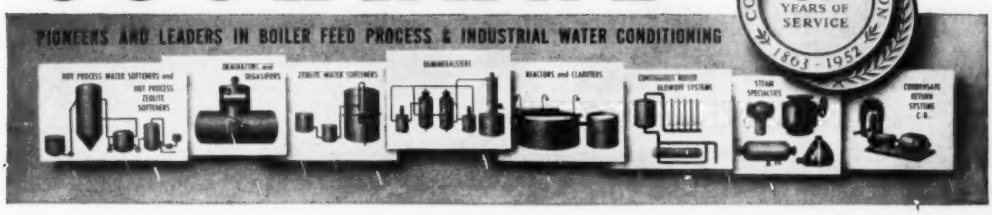
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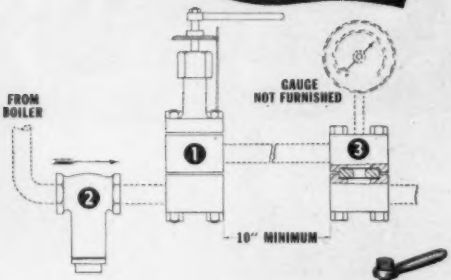
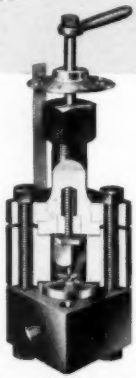
CONTINUOUS BLOWDOWN





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80 Series Trap

Strainer

STRONG

MARMADUKE

Continued from page 202

small frogs, tadpoles, fish and weeds.

"We finally filled the boilers and started up the plant. The laborers went down to the quarry. But an hour later the corliss started running away. Before I could reach the throttle, the wrist-plate stud snapped off. That was a break in more ways than one, because it stopped the engine dead before her flywheel could explode. The boss sent down the road for a welder. By quitting time I had the engine going again.

"No one knew what speed the engines were supposed to run, and no one cared. The governor belts were so oil soaked and covered with stone dust that they took to slipping at times. Then the engines would speed up.

"The boilers took to priming in spurts. The fireman would run to the engines and open the drains while I blew the boilers down to reduce concentration.

"'Look here,' I told the boss after shutting down that evening, 'this plant is dangerous. Before I stay on, I'll have to make it safe.'

"'Safe,' he hollered. 'What in hell makes you think it ain't safe? I've owned this place a dozen years and she's been running all the time. What do you propose to do?' he snapped.

"'First,' I informed him, 'as a licensed engineer, it's my duty to look inside those boilers and see what shape they're in. That means I'll shut down this weekend and give them the once over. I'm sure they're dangerously scaled from that pond water.'

"The boss sat there chewing tobacco and staring at me, getting pink around the gills.

"'Next,' I told him, 'I'll put a large strainer in the frog pond on the end of that feed line. I can run a steam line into the strainer to blow it free when it gets plugged, or the fireman can clean it each day. That'll save you costly shutdowns and the danger of burning up your boilers.

"'Then I'll replace all those oil-soaked belts with new so the engines don't take off and wreck the plant. After that, I'll overhaul engines and compressor as I get a chance, make them run smooth as good equipment should. But right now, I'm mainly interested in what's inside those boilers,' I harped before he could open his trap. 'Then I can take things in my stride, overhaul everything in a few months.'

"Those suggestions burned the old boy up plenty. 'You ain't gonna shut down and I don't need no screen or nothing else,' he exploded finally. 'When the boilers don't get enough water, I'll just send for the powder monkey. So if you have any more hot ideas about spending

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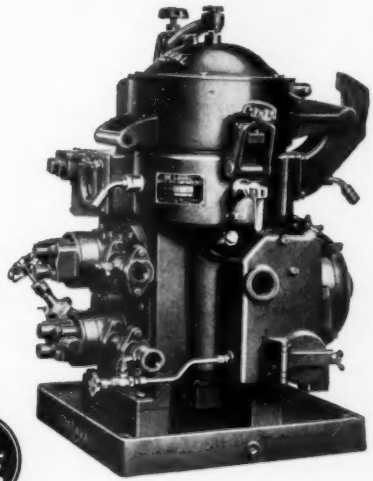

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MARMADUKE

Continued from page 204

my money, you just keep on traveling.'

"'OK,' I answered, 'safety is my first duty. If you can't see that I'll cut your expenses eventually, I'm shoving off.'

"'That suits me,' he yelled, and paid me off on the spot.

"'There's one thing I'd like to know before hitting the road,' I said. 'That's how a business man figures it's cheaper to shut down every few days, and take chances of wrecking expensive equipment, than to install protective equipment and run a plant the right way.'

"He didn't answer and I didn't stay to find out.

"That was 30 years ago," wound up Marmaduke, hoisting himself to his full six feet, four inches, "but I've run into so many owners like him that I don't even ask such questions any more."

DEMINERALIZATION

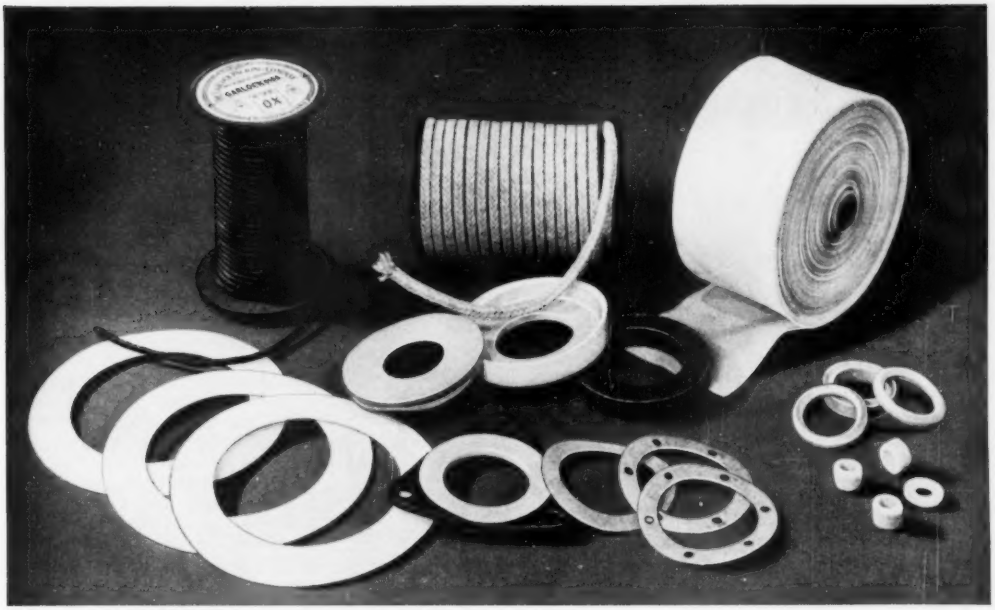
Continued from page 97

ferences in boiler-water demand and demineralization plant output. Under such a working arrangement we were not always able to keep the water level above the inlet pipe's discharge. As a result very pure water with practically no CO_2, extremely low O_2 concentrations, discharged into the atmosphere and dropped to the water surface in the tank. Water pH went from 8.6 at inlet to 7.9 at outlet, from no CO_2 to 1.5 ppm, dissolved oxygen from 0.03 to 3.05 ppm!

We tried a nitrogen blanket above the water surface to prevent this but with discouraging results. To date we have made every effort to keep the inlet line submerged. And as a step in this direction we lowered the inlet line to 25 ft from the top.

Second and third cyclone units draw their water from a separate 640,000-gal tank only 200 yd from the demineralization plant. The same piping arrangement applies here—14-in., cast-iron, bitumastic, enamel-lined pipe feeding in at a point 10 ft from the tank top with a bottom tank discharge. Both boilers have not been off at the same time so we have not been able to lower the inlet piping. However, we've been able to keep this line submerged 90% of the time.

Some of the demineralized water (as much as 300 gpm) cools furnace access doors, slag spouts, cyclone front-plates, soot blower's air-compressor cooling jackets, oxygen samplers, wherever there's no danger of contamination. After performing this cooling we collect this water and return it to the suction of the forwarding pumps to join cold



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	Concentrated Hydrogen Peroxide
Bromine	Oxygen
Chlorine	Sulphuric Chloride
Fluorine	Sulphur Oxychloride

TEFLON packings and gaskets are recommended for use at operating temperatures from below −90° F. up to 500° F. Within this wide temperature range these packings and gaskets retain their inherent toughness, have a low coefficient of friction, and do not react with metals of construction.

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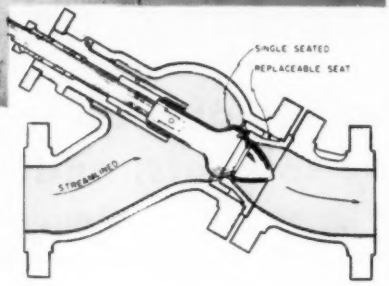

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Cono-Controls

CC-118

DEMINERALIZATION

Continued from page 206

demineralized water on its way from storage tank to exhaust steam deaerators.

Hot Deaeration. A 500,000-lb-per-hr atomizing deaerator receives the feedwater for the first cyclone-fired boiler and a second 950,000-lb-per-hr unit handles the water for the second and third boilers. About 20% of the total 250-F discharge from these deaerators consists of condensed exhaust steam. Modified Winkler analyses have never revealed a trace of dissolved oxygen.

When Section 2 first went into operation we never adjusted pH of the finished water but took it at whatever pH the anion effluent ran, sometimes as low as 7.0. Iron pickup, though, proved appreciable going from 0.01 ppm in the demineralized water output to as high as 0.1 to 0.2 after flowing through the preboiler piping.

With adjustment of pH leaving the demineralizer to 9.0 and careful handling in the outside storage tank, iron content in the water entering the boiler measures about 0.02 ppm. Adding ¼ ppm of a septaphosphate to the water leaving the demineralizer also helps reduce iron pickup. We considered volatile amines for pH correction, but because the steam from these boilers goes directly to process we selected caustic soda to insure chemical purity.

Results stay so consistently good that a 1953 expansion to 5000 gpm with an ultimate of 8000 includes converting Section 1 to the same process as Section 2, a battery of 12 filters, two additional cation exchangers, a new plant to be called Section 3.

CONTROL, INSTRUMENTS

Continued from page 90

peratures and so will any movement of the proportioning dampers within the boiler. This is one instance showing why temperature regulation is the toughest control problem today.

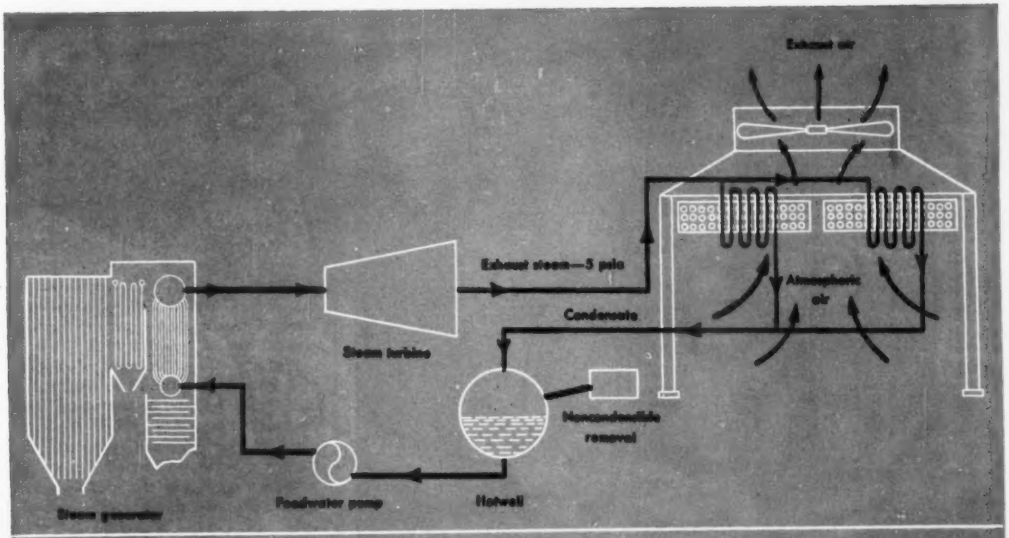
C H Barnard, Bailey Meter Co: Four types of feedwater-control systems are used today: (a) single-element self-operated (b) single-element pilot-operated (c) 2-element pilot-operated (d) 3-element pilot-operated.

Fig. 4 shows one type of single-element self-operated system. A generator with two concentric tubes has the inner tube connected to the drum to detect the water level. Water fills the annular space between tubes when the generator is cold. This space connects to the bellows-operated spring closing feedwater valve in the feedwater line.

When hot, the inner tube transfers

ALCO AIRCOOLERS

condense steam



in dry-location steam power plants

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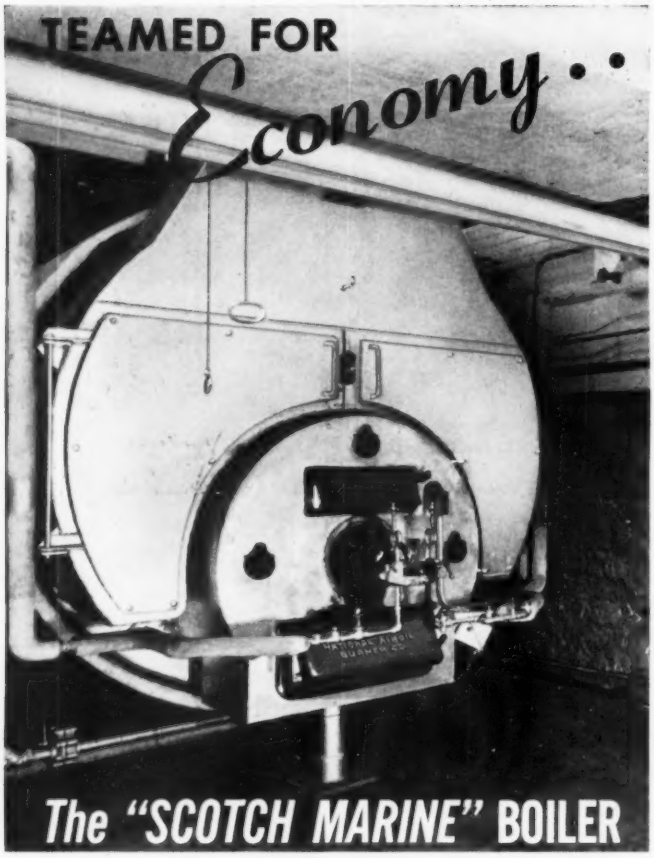

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CONTROL, INSTRUMENTS

Continued from page 208

more or less heat as the water level varies. When water level drops, more heat transfers to the outer tube, raising the pressure and forcing the valve open. This type carries a high water level at low ratings and low levels at high ratings.

While this regulator is simple in operation, low in cost, and doesn't need external power to operate it, it hunts severely with rapidly changing loads. Hence it's recommended only for fairly steady load conditions.

Fig. 5 shows a single-element pilot-operated regulator. The water-level recorder operates an air pilot valve, which through a relay and indicator controls the feedwater valve. Automatic reset of the pilot valve enables holding constant level. Indicator panel permits remote manual control of water level.

Fig. 6 shows a 2-element pilot-operated system. In addition to level measurement an orifice in the steam line measures steam flow. Each measurement acts on the relay to control the feedwater valve. Steam flow acts as the primary control with the level measurement acting as a readjusting control only.

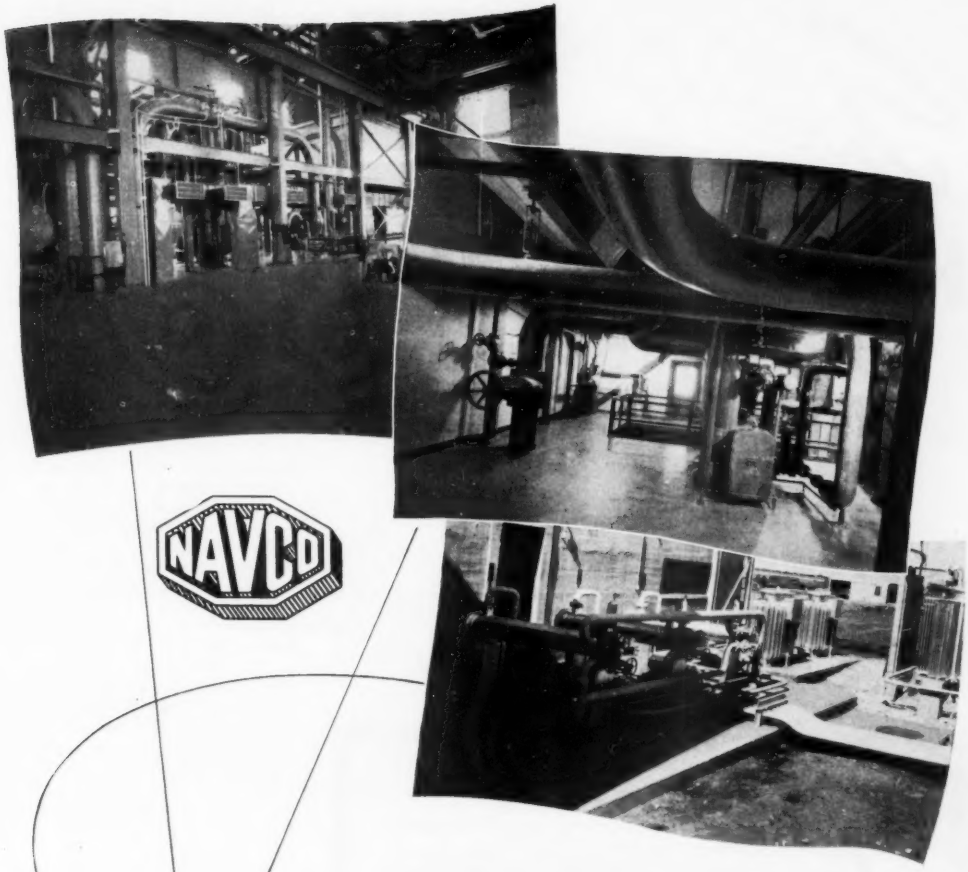
All these systems will do an abnormal amount of adjustment where feedwater pressures vary ahead of the feedwater-control valves.

Fig. 7 shows a 3-element pilot-operated system. This uses an additional feedwater-flow measurement. Ratio of steam and water flow exert primary control with readjustment by the level measurement. Changes in water flow from change in water pressure can be immediately compensated by adjusting the feedwater valve. Practically all large boilers use this system of feedwater control.

Table on p 90 gives recommendations for making a selection from these control systems for specific applications.

Feedwater pressure depends on pump speed and flow. Present-day popularity of electric-motor-drive of feed pumps has led to widespread use of constant speed. This introduces pumping power losses at loads less than rated because of the pressure that must be dissipated in the feedwater control valve, Fig. 9.

Advantages of variable-speed pumps with constant-speed drives have been realized by using variable-speed couplings. Fig. 8 shows an installation using a 3-element control with pump speed fixing feedwater flow rate. The feedwater control valve can be left in wide-open position during normal conditions. Conservative designers feel the valve is needed for putting the boiler on



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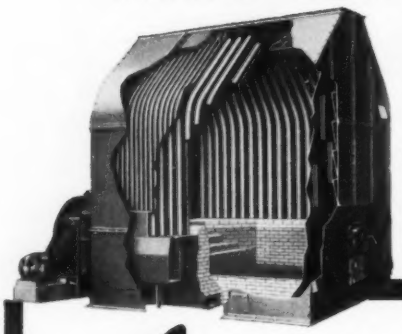

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CONTROL, INSTRUMENTS

Continued from page 210

the line, and during abnormal pump conditions. Some installations have been made omitting the control valve entirely.

M J Boho, Hagan Corp: In the future it will probably be a rare thing not to have a boiler equipped to fire all three fuel types. This will need control systems for burning these fuels in all possible combinations. It will mean more control gear, but a medium-sized boiler of today in one year burns fuel worth over 100 times the cost of instrumentation.

Economic conditions now make it desirable to lower flue-gas temperatures by additional heat-transfer surface. Fouling and corrosion of these surfaces limit the minimum temperature that can be used. Conceivably instruments could measure and control this temperature to realize maximum boiler efficiency and avoid excessive air-heater maintenance.

Further opportunity for reducing excess air to burners now exists under ordinary operation. Air-flow measurements to burners will receive more careful consideration. Venturi tubes and temperature-compensated instruments will find general use.

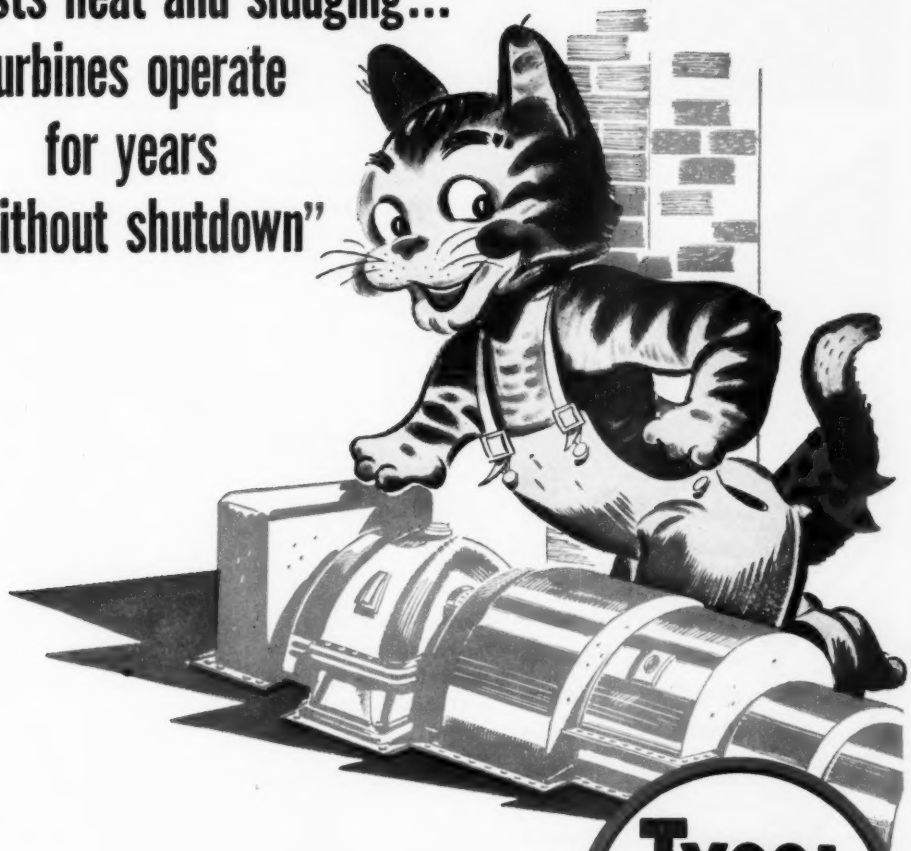
Automatic control of blowdown and chemical addition will be possible in the near future. Automatic blowdown controls, tied in with wide-range metering apparatus, and density-compensated drum water-level measurements may eventually permit automatic operation of a feedwater-control system from off the line, to regular operation, and off again.

At the present time a large boiler on the West Coast has a steam output range of 20:1. Under automatic control it burns liquid or gaseous fuels. Other steel-mill boilers for periods up to 14 yr have taken large load swings up to 50% or more of maximum output in two or three seconds under automatic control. When burning gas or pulverized coal these same units operate from standby to maximum load without human attendance.

The process being controlled is the most important link in the control loop. Often improved control with simpler circuits can be realized if response of the controlled system is speeded up. Superheating control systems on boilers are more complex than they need be if boiler designers could speed up superheating response.

Failure to appreciate reliability of present-day mechanisms has resulted in excessive use of manual-control stations. This has made unnecessarily-large panel boards. In the future more dependence on automatic operation will allow con-

"Tycol Aturbrio resists heat and sludging... turbines operate for years without shutdown"



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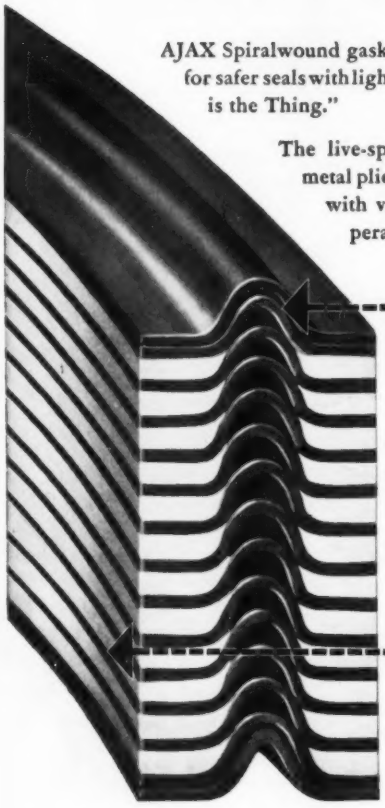

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siderable simplification and reduction in size of panel boards.

It seems almost certain that transmitting-type instruments will be used more frequently in the future. In addition to reducing control-room hazards they permit combining several variables into one measurement.

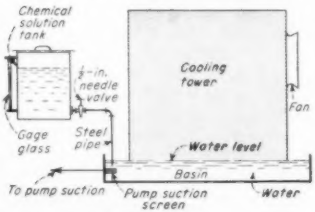
More PLANT PROBLEMS

Begins on page 132

Other readers who submitted similar answers are as follows:

A M PALMER — *Brooklyn, N. Y.*
F J ARDALINO — *Brooklyn, N. Y.*

Another answer to Q 1, Feb *Power*
What Turns Cooling-Tower Water Red?



LEACHING of redwood by circulating water causes water to turn red. This condition isn't unusual and will disappear in time as system is drained for cleaning or winter protection. Keep red water in system as long as possible because tannin in water protects pipe from corrosion.

Rise in water acidity or oxygen concentration steps up corrosion. Carbon dioxide and sulphur dioxide can be absorbed from air passing through tower. When this happens the water becomes more acidic.

Keep water slightly alkaline by adding sodium silicate at regular intervals. But before doing this call in water specialist and have him analyze water in tower. Then you'll be sure you're adding right chemicals.

Chromates, glucosates, polyphosphates, tannins, lignins, starches and combinations of these have also been found useful in treating cooling-tower water. Sketch shows a continuous gravity feeder for injecting chemicals to cooling-tower basin. Delivery rate isn't constant because head varies as liquid in tank falls. If continuous feed is needed use a small motor-driven controlled-volume pump between tank and basin for best results.

J D CONSTANCE
Cliffside Park, N. J.

Stud-and-Nut Combination Resists Fatigue Failure

--------Stays on Job at HIGH Temperatures

For bolting applications involving high temperatures or high pressures, it pays to use the Bethlehem Continuous-Thread Stud, together with two Bethlehem Quenched Nuts.

This stud-and-nut combination is ideal for difficult bolting jobs because it resists the premature fatigue failure often induced by fluctuating temperatures and pressures. It's an economical combination, too, because of its long service life.

The Bethlehem Continuous-Thread Stud has no point of thread-runout. Therefore those stresses which could contribute to early failure are well distributed over the full working length of the stud, rather than being allowed to gather at any one point.

The Bethlehem Quenched Nut, made from .40 to .50 carbon steel, is formed by forging and extruding hot steel in a forming die. It is then quenched and tempered. This procedure makes the nut sufficiently strong to break virtually any stud or bolt on which it may be used. Like its companion stud, the Quenched Nut is furnished in a wide range of sizes.

It will be well worth your while to consider Bethlehem Continuous-Thread Studs and Quenched Nuts for high-temperature bolting. The nearest Bethlehem office is at your service.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

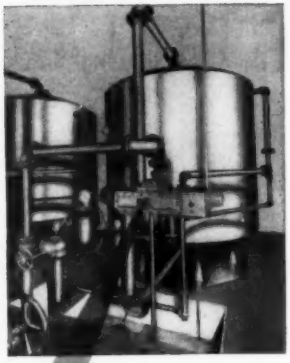
On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

Bethlehem supplies every type of Fastener

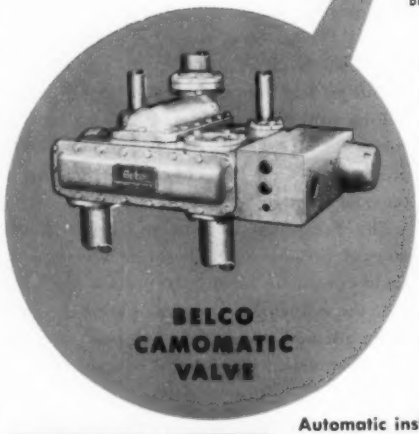
PROCESSES FOR REMOVAL OF WATER IMPURITIES

BELCO combines the best in design with automatic control



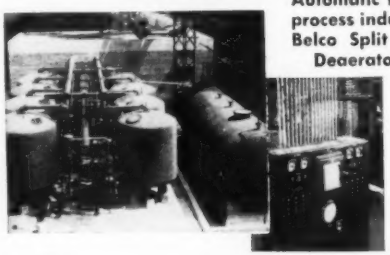
BELCO CAMOMATIC VALVE

The Belco Camomatic Valve replaces the seven individual valves required for normal softener operation. When instruments indicate, or when a predetermined amount of raw water has been used the softening cycle is set in operation, automatically. The Camomatic valve is easily adapted to pressure filtration and other process control. These valves are being used in some of the country's finest plants.



BELCO CAMOMATIC VALVE

Automatic installation in large process industry. Panel controls Belco Split Stream Plant and Deaerator, automatically.



Belco has built the largest automatic silica removal demineralizer plant in the world. Your needs will be met with unmatched engineering knowledge and with equipment designed to do your job.

BELCO ATOMIZING VALVE

*We invite your consultations regarding all water conditioning requirements. Get acquainted with our organization for authoritative assistance and close cooperation. Write for late descriptive bulletins.

BELCO HIGH PRESSURE STEAM DEAERATOR

Belco

Belco Industrial Equipment Division, Inc.

PATERSON 3, NEW JERSEY

OUR REPRESENTATIVES ARE LISTED IN THOMAS' REGISTER

WITH OUR READERS

Continued from page 5

43-yr association led us to wonder how many others have read POWER most of their lives. Let's hear from some of you old-timers and see who holds the record.—ED.

WHAT'S AN ENGINEER? . . .

The letter from Mr Cannon (Feb, p 140) *under the heading* "What Sort of Engineer Are You?" *reminded me of a definition of an engineer I heard in an office where I was employed many years ago.*

A young engineer was away from his desk when his phone rang. It was answered by a clerk. Apparently a girl was calling and when the clerk told her that "Mr Smith" was out of the office, she took the opportunity to check up on her boy friend's importance by asking, "What does Mr Smith do there?" The clerk's reply was, "Why, he doesn't do anything. He's an engineer."

I have heard many definitions of engineering, from the one given above to the one credited to the late Henry G Stott, who was one of the pioneer power engineers and was first superintendent of motive power for the Interborough Rapid Transit Co. His definition ran as follows: Engineering is the science of controlling the forces and of utilizing the materials of nature for the benefit of man, and the art of organizing and directing human activities in connection therewith.

New York, N. Y. HERBERT B REYNOLDS

$250,000 More for Atomic Power Research

The prospects of economic atomic power are so promising that Dow Corp and Detroit Edison Co will spend another quarter-million dollars to continue their joint nuclear-fuel research for the coming year. They believe this will give them a chance to get in on the fledgling atomic-power business at the ground level.

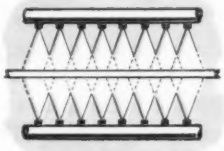
They are one of four industry-utility teams now working with the Atomic Energy Commission to find a way to produce commercially feasible electric power from atomic energy. All four teams are cautiously optimistic that the difficult technical and cost factors involved will eventually be solved.

The Dow-Detroit Edison team, which has AEC approval to continue study for another year, is developing reactors and chemical separation processes. But it will not produce a final reactor design.

AEC also expects to spend $750,000 on its own atomic power studies in the coming year. It is evidently pleased with results so far obtained by the industry-utility teams, and plans to set up an office of industrial cooperation to foster wider industrial participation. Commissioner T Keith Glennan of the AEC believes that ultimately business and industry should take over the entire field of nuclear-fueled electric power development.

HYDRAULIC DESCALING IS FAST, CHEAP AND EFFECTIVE

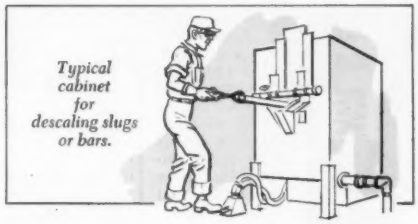
SCALE which forms when metal is heated during production can become a problem if it is not properly removed. Scale can affect the size, weight and quality of your finished product. Scale can cause unnecessary wear on your cutting tools, punches, dies and machinery.



Descaling flat stock, showing spray overlap.

Effective descaling need not be a slow, costly manual or mechanical process. With hydraulic descaling you can efficiently knock off scale with high velocity jets of water in a matter of seconds!

The heart of the hydraulic system is the pump which delivers the high pressure water. The BJ Hydropress pump is ideal for this type of work because of its unique construction features. It does not require relief valves, accumulators or extra heavy fittings and piping. Its double volute design creates inherent balance at all heads and capacities.



Typical cabinet for descaling slugs or bars.

Its vertical construction allows the use of a simple foundation and a minimum of floor space.

For more information on how BJ may solve your pumping problems, call your local BJ sales engineering office today!

BJ HYDROPRESS PUMPS ARE YOUR ANSWER

These BJ Hydropress pumps provide capacities to 300 gpm and pressures to 3000 psi. One pump can serve a number of descaling cabinets or booms.

Write for BJ Hydropress Bulletin No. 48-6400. No obligation, of course.

Byron Jackson Co.

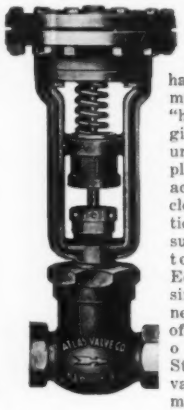
Since 1872

P. O. Box 2017 Terminal Annex, Los Angeles 54, Calif.

OFFICES IN PRINCIPAL CITIES

ATLAS
Type "D" Reducing Valve

The exceptional valve shown below is our ATLAS Type "D". In our 52-page Bulletin 1-A it is shown as Fig. 171. Be sure to ask for Bulletin 1-A if interested as that bulletin gives complete information including cross-sectional views, list of parts, etc.



Ever since its introduction, Type "D" has made very much of a "hit" with engineers. It is unusually simple. Also gives accurate and close regulation of pressures. Is easy to inspect. Equipped with single seat renewable discs of composition of metal Stainless steel valve stem. Removable diaphragm top. Adaptable to steam, air, or gas. Up to 175 lb. per sq. in. pressure. Durable. Body of bronze. Screwed ends. And, its construction gives it true balance with double port seats.

Be assured of best regulating valve service by always putting your regulating problems in the hands of ATLAS engineers. For more than a half century we have been specializing solely in regulating valves. See the list of principal ATLAS Power Plant Products below. Make use of the coupon.

ATLAS VALVE COMPANY

287 SOUTH ST., NEWARK 5, N. J.

Represented in Principal Cities

☐ Without obligation, please send me the ATLAS Regulating Valve Bulletin No. 1-A. Also, please send complete data on the following products:

☐ Damper Regulators	☐ Pump Governors
☐ Temperature Regulators	☐ Oil Control Cocks
☐ Exhaust Control Systems	☐ Humidity Controllers
☐ Pressure Regulators	☐ Thermostats
☐ Campbell Boiler Feed Water Regulators	☐ Balanced Valves
	☐ Control Valves

Name .....

Firm .....

Address .....

My Biggest Boner

► OUR OLD FREIGHT ELEVATOR was rewired because too many electrical troubles were plaguing us. The electricians finished all the work except connecting new leads to the motor. I rode the car to the basement and pulled the disconnect switch.

It took only a few minutes to change from the old to the new leads. When they were in I threw the switch and got in the car. I pulled the shipper rope to go up but went down instead.

I grabbed the shipper rope to stop the car but it was too late. Counterweight hit beams at the second floor ceiling. I heard a shackle break and a ton of counterweight whistled by me on a fast trip down. It dug a hole in the concrete floor of the elevator pit, just about four feet from me. Cables came down a little slower but they didn't sound pleasant when they hit the car roof a foot and a half from my head. I was plenty scared.

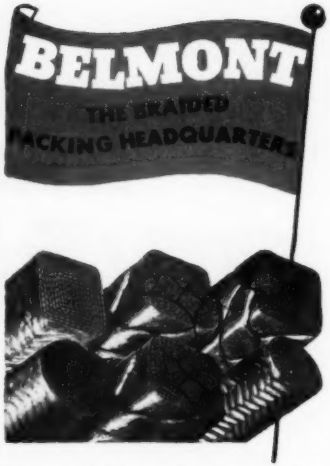
Of course there should have been a low-limit switch on the car or a high-limit switch on the counterweight but it was still a bonehead stunt on my part.

Now I always check rotation after hooking a motor to a machine. You never know when you may cross leads and wreck the machine or even kill yourself.

G F NEELY

Vancouver, Wash.

• What is your "biggest boner"? We'll pay ten dollars for each one we publish.



No one *deliberately* compromises with quality in vital braided packings. You're probably *paying* for the best, so why not make certain you're getting it—specify BELMONT, headquarters for braided packings in a wide range of types and materials.

Belmont braided packings are described and picturized in catalog No. 40. The type of braid is dependent upon the service conditions, and the materials used are asbestos, flax, cotton, jute, ramie, teflon and metals, lubricated for the purposes intended. Write on your company letterhead for details today.

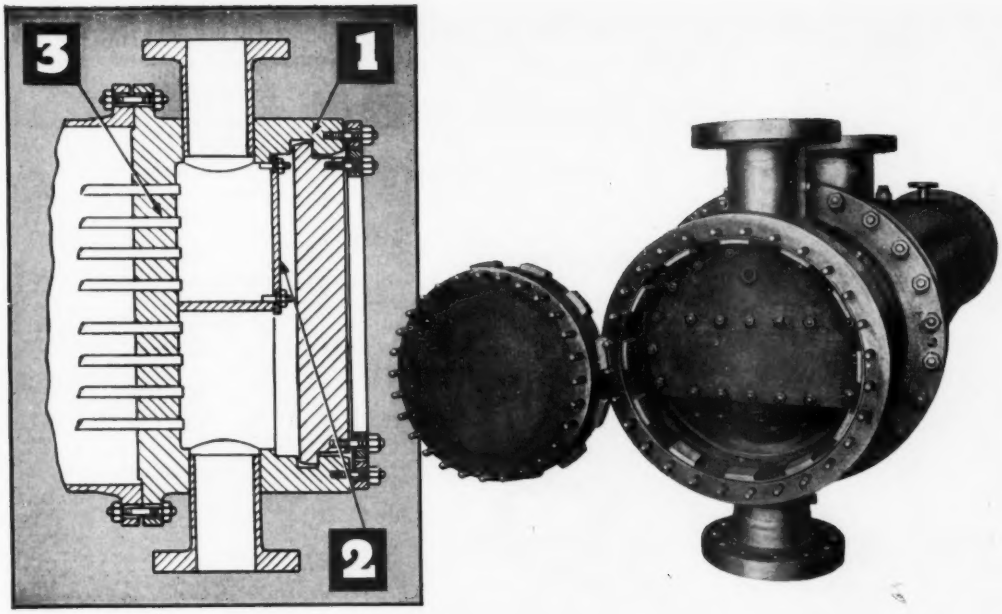
Fast, *direct* help on technical problems . . . SERVICE through leading national distributors.

4-M-2A

for Steam • Water • Oil • Gas • Air Acids • Alkalies • Ammonia

THE
BELMONT
PACKING AND RUBBER CO.
Butler and Sepviva Streets
Philadelphia 37, Pennsylvania

Rings • Spirals • Coils • Reels
Spools • Sheets • Gaskets
There's a Belmont Packing for every service



Your 3 WAY protection against leakage in this G-R Feedwater Heater

1 At the water head covers

You know how the barrel and breech block in big guns are locked by lugs or projections. The same effective closure principle assures complete tightness for the water head covers of G-R High-Pressure Feedwater Heaters. In these units, interlocking lugs carry the hydraulic load . . . therefore no need for the large number of heavy bolts required by other high pressure heater designs.

2 At the pass partitions

Here's a fruitful source of leakage that can't even be detected in many designs of feedwater heaters. You'll have no worry on that score with G-R Feedwater Heaters, because in these units the differential in water pressure between passes helps to keep the partition joints *tight* instead of tending to force them apart. The sketch tells the story.

3 At the tube sheet joints

83 Years of experience in building heat transfer apparatus have taught G-R how to make tube sheet joints *lastingly* tight. This unequalled experience . . . based on the results obtained in many hundreds of thousands of installed units . . . is your assurance of uniformly thorough tightness of all tube ends in every tube sheet.

Write for bulletin describing G-R Feedwater Heaters in detail.

THE GRISCOM-RUSSELL CO., MASSILLON, OHIO

GR 260

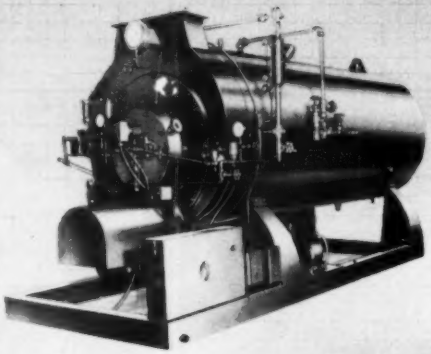
GRISCOM-RUSSELL

PIONEERS IN HEAT TRANSFER APPARATUS

3=5

when you use

Cyclonic Combustion!



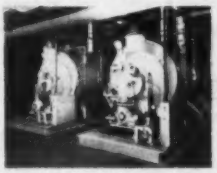
Yes, 3 square feet of heating surface with Cyclonic Combustion equals the 5 square feet of heating surface offered to you by other packaged boiler units.

The Cyclotherm Cyclonic Combustion Principle is an entirely new and amazingly different method of heat transfer in the boiler industry.

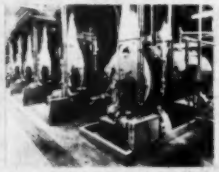
Air enters the combustion chamber at extremely high velocity in a revolving spiral vortex which travels the entire length of the furnace. The fuel is introduced into the entering air where it is slowly consumed as it moves in a cyclonic motion down the combustion chamber. This highly luminous slow burning flame radiating heat to the fire tube through direct radiation and by convection, results in an unusually high rate of heat transfer.

Boilers are designed for oil or gas operation from 18 through 500 HP, 15 to 200 lbs. operating pressure.

Full power operation from a cold start in 15 to 20 minutes. Savings up to 50% on maintenance. Guaranteed 80% efficiency.



When large installation requirements exceed 500 HP, sizable fuel savings can be obtained by battery installations. Based on an analysis of your steam requirements, a number of units would be recommended which collectively add up to your peak steam demand.



On one typical installation as shown above, a battery of 200 HP Cyclotherms has saved over $12,000 a year in fuel alone. Maintenance and operational cost have been reduced to 75%.

CYCLOTHERM steam generators

CYCLOTHERM DIVISION UNITED STATES RADIATOR CORP.

CYCLOTHERM, DEPARTMENT 24, OSWEGO, NEW YORK

More FREE BULLETINS

Begins on page 163

ELECTRICAL EQUIPMENT

B14 SELENIUM RECTIFIER STACKS — Characteristics, applications. 28-page booklet GET-2350 illustrates principles, design, manufacture. General Electric Co, Schenectady 5, N. Y.

B15 LIGHTING—*See Better—Work Better* bulletins No. 6 and 7, dedicated to promoting better lighting and thus improved production. Inquiry Bureau, General Electric Co, Nela Park, Cleveland 12, Ohio.

B16 COMPRESSION JOINTS — For copper or aluminum cable. 32-page catalog 67 features waterseal lugs, aircraft cable terminals, one and two-hole lugs, hydraulic installing tools. Tables, charts, photos. Thomas & Betts Co, Inc, 46A Butler St, Elizabeth 1, N. J.

B17 ELECTRICAL METALLIC TUBING — *Dekoron-Coated. Electrunite* tubing resists effects of corrosive atmospheres. 8-page folder gives properties, uses, methods of application. Steel and Tubes Div, Republic Steel Corp, 224 E 131st St, Cleveland 8, Ohio.

B18 VARIABLE TRANSFORMER — *Powerstat* type 10 for ac service at 50 to 150 watts. 4-page bulletin P252 has photos, description, specifications. R F Greene, Superior Electric Co, Bristol, Conn.

B19 MOTORS AND CONTROLS—For the chemical process industries. 34-page booklet B-4792 treats 8 separate general application problems, suggests solutions. Construction details, photos. Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.

B20 MOTORS AND CONTROLS—For the textile industry. 32-page booklet B-5422 discusses problems common to the textile industry, suggests motor and control solutions. Photos, drawings, construction details. Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.

B21 PYROMETRIC SWITCHES—Rotary, key and plug types for thermocouple and resistance thermometer bulb circuits. 12-page bulletin 5800 gives dimensions, mounting details, circuits. Minneapolis-Honeywell Regulator Co, Brown Instruments Div, Station 40, Wayne & Windrim Aves, Philadelphia 44, Pa.

B22 AUXILIARY POWER — Portable electric generating plants provide emergency or standby power. 400 to 6000 w capacity, ac and dc models, also 5 to 35 kw standby plants. Folder A-292 gives specifications, descriptions. D W Onan & Sons, Inc, Minneapolis 14.

B23 ELECTRIC POWER DRIVES—Variable-speed, geared, and constant-speed drives in drip-proof, splash-proof, totally enclosed and pipe ventilated designs. 20-page catalog shows construction, operation, photos, diagrams. Sterling Electric Motors, Inc, 5401 Anaheim-Telegraph Rd, Los Angeles 22, Calif.

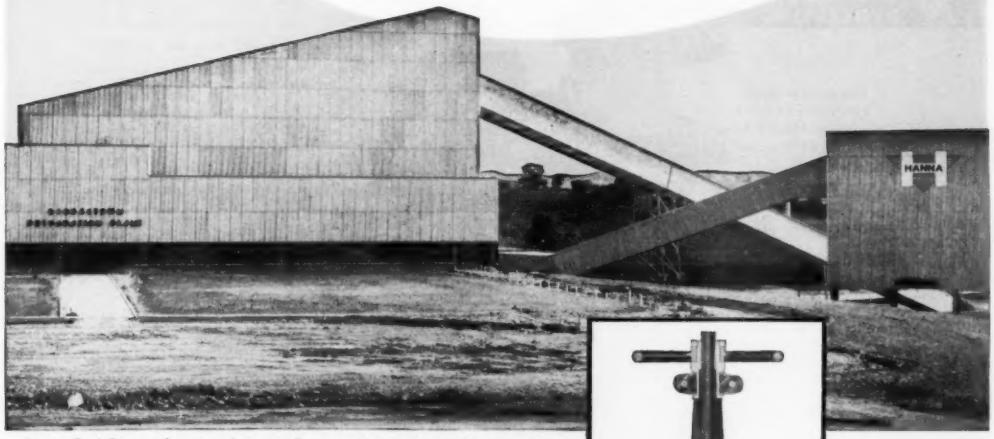
B24 VERTICAL INDUCTION MOTORS —60 hp, 200 rpm, to 800 hp and larger, 1800 rpm, for pump service. Open, self-ventilated type. 4-page bulletin 05B7629 shows photos, construction, ratings. Allis-Chalmers Mfg Co, 952 S 70th St, Milwaukee 1, Wis.

B25 GEAR MOTORS — 61 standard fractional hp models. 8-page bulletin GEA-5678 describes applications, outlines method of determining hp requirements with only a pipe wrench and fish scale. Photos, drawings, selection charts, dimensions. General Electric Co, Schenectady 5, N. Y.

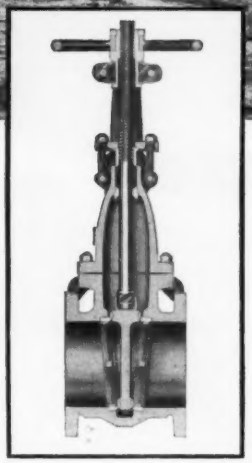
B26 PULSE TRANSFORMERS — Miniature three-winding type for low-power applications. For triggering and counting circuits, dc isolation, pulse shaping, etc. 2-page bulletin gives construction and characteristics. Engineering Research Associates, Inc, 1902 W Minnehaha, St. Paul 4, Minn.

(*Continued on page 222*)

Hanna Coal Company Preparation Plant ... served by the OIC LONG LINE of valves



Hanna Coal Company's mammoth new coal preparation plant in service now at Georgetown, Ohio.



"We've standardized on OIC Valves; all kinds for all kinds of service. They're the best!"

Hundreds of OIC Valves—iron, bronze and steel—were used in this coal preparation plant, completed just a year ago. OIC Valves were selected by Hanna Coal Company after many years' experience with these valves at their other properties—evidence of the fine performance they provide.

Simplify your procurement problems by calling the nearby OIC distributor. The OIC Long Line offers the right valve for every job.

THE OHIO INJECTOR COMPANY
WADSWORTH, OHIO

OIC
FOUNDED 1883

VALVES
FORGED AND CAST STEEL · IRON · BRONZE

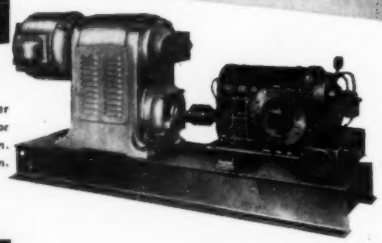
Standardaire

AXIAL FLOW POSITIVE PRESSURE

BLOWERS

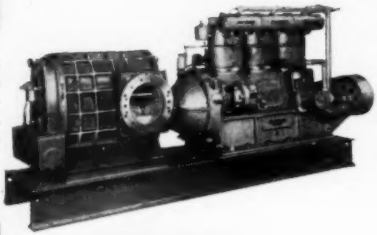
provide air to the specific needs of many important industries because Standardaire Blowers are unique in design and construction—unequalled in quality and performance.

for **CHEMICAL PROCESSING**



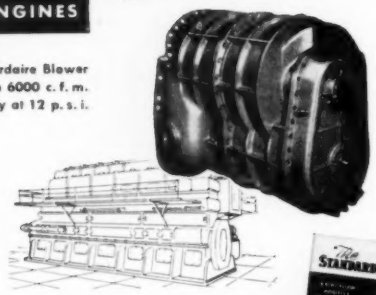
Standardaire Blower with Varidrive Motor to deliver 780 c. f. m. at 1750 r. p. m.

for **SEWAGE PLANTS**



Standardaire Blower with Climax Engine using sewage gas—to deliver 2100 c. f. m. at 720 r. p. m.

for **DIESEL ENGINES**



Standardaire Blower with 6000 c. f. m. capacity at 12 p. s. i.

AXIAL FLOW STANDARDAIRE BLOWER

Write DEPT. F-43
for Publication No. 90
BLOWER-STOKER DIVISION

READ STANDARD CORPORATION

370 LEXINGTON AVE., NEW YORK 17, N.Y.

More FREE BULLETINS

Begins on page 163

B27 TRANSFORMERS — Indoor and outdoor, dry type, 600v and below, single phase, 3 to 200 KVA. 4-page bulletin 6-01 gives construction, specifications. Magnatran Inc, 243 Schuyler Ave, Kearny, N. J.

B28 PRODUCT INDEX—Batteries, capacitors, contacts, rectifiers, resistors, switches, vibrators, tuners, etc. 12-page bulletin gives basic specifications, features, applications on complete line. P R Mallory & Co, Inc, 3029 E Washington St. Indianapolis 6, Ind.

B29 SAFETY WIRING — Mineral insulated system. 4-page bulletin gives 20 questions and answers on characteristics and advantages of system, lists types, sizes, weights, lengths. General Cable Corp, 420 Lexington Ave, New York 17, N. Y.

B30 GROUND FITTING SELECTION —Chart shows how 30 common combinations of ground wire and water pipe sizes can be made from only 10 stock parts. Thomas & Betts Co, Inc, 46A Butler St, Elizabeth 1, N. J.

B31 DC POWER SUPPLY — *Varicell* unit gives variable stabilized-regulated dc voltages from ac power lines. 4-page bulletin V1051 shows circuits, photos, descriptions. R F Greene, Superior Electric Co, Bristol, Conn.

B32 STOCK LIST — Electrical and power equipment. Motors, generators, transformers, blowers, pumps, air compressors. New and used units. 36-page circular P-3-52. O'Brien Machinery Co, 1539 N Delaware Ave, Philadelphia 25, Pa.

HEAT EXCHANGERS

B33 COOLERS—Also condensers, heat exchangers, evaporators. 66-page bulletin gives capacities, dimensions, applications, installation instructions, prices. Heat-X-Changer Co, Inc, Brewster, N. Y.

B34 HOT WATER GENERATOR—Standard units with capacities from 5 to 300 gpm, temperature rises from 5 to 150 F. 8-page bulletin 22 gives construction, operation, capacities, specifications. Aerco Corp, 214 Lafayette Place, Englewood, N. J.

B35 INDUSTRIAL PROCESS HEATING—16-page bulletin gives information on materials handling, temperature cycles, heat application, fuels, auxiliary equipment. Also description of *Pan-L-Heat* ovens. Jensen Specialties, Inc, 9335 Freeland Ave, Detroit 28, Mich.

MAINTENANCE MATERIALS

B36 GLASS BLOCKS—Light-directing and light-diffusing functional units, 12- and 8-in. sizes. 4-page folder gives recommended elevations, descriptions, daylighting performance. Pittsburgh Corning Corp, 307 Fourth Ave, Pittsburgh 22, Pa.

B37 MODERN FUEL OILS — And the application of additives. 8-page reprint from *Industry and Power* gives information about burning problems, elimination of sludges and deposits, slag and soot. E F Drew & Co, Inc, 15 E 26th St, New York 10, N. Y.

B38 OILS, WAXES, GREASES—*Kel-F* has chemical inertness and resistance to high temperatures. 4-page technical bulletin 5-1-52 gives specific information on properties, applications, shows typical viscosity and density curves. Chemical Mfg Div, M W Kellogg Co, P O Box 469, Jersey City 3, N. J.

B39 MOLYBDENUM DISULFIDE LUBRICATION—Abstracts, bibliography and case histories. 4-page technical bulletin 21-G gives descriptions, characteristics, prices. Lockrey Co, Lubricants Div, Southampton, N. Y.

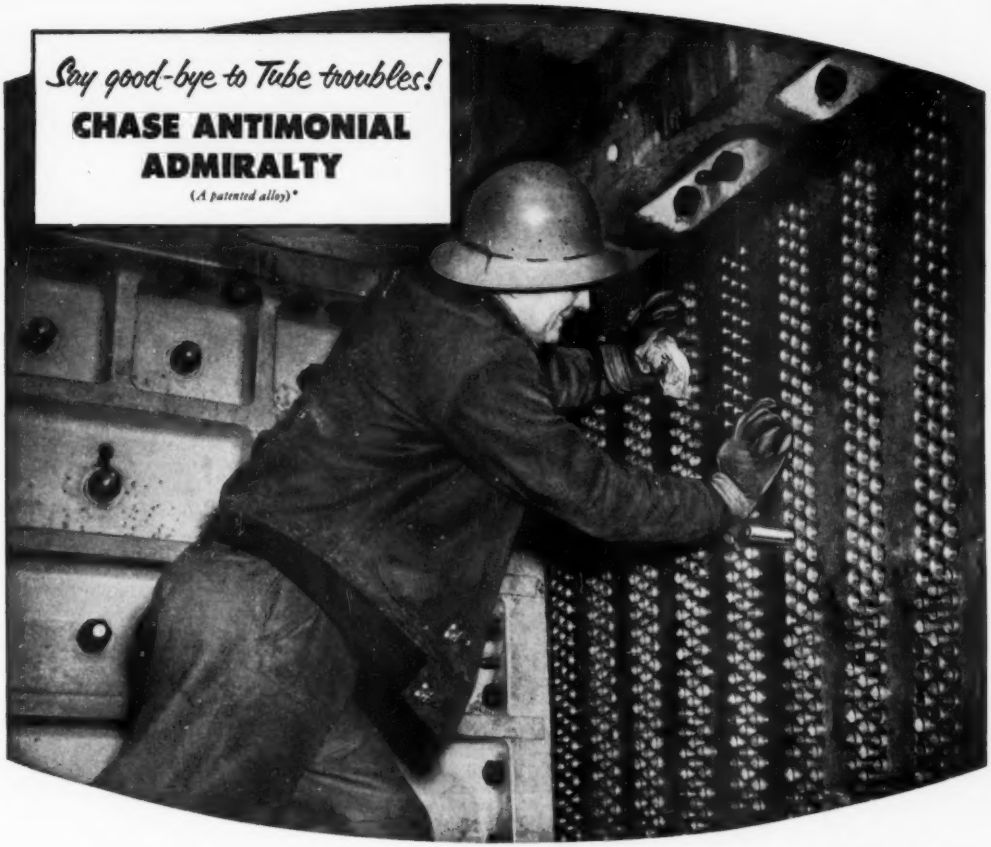
B40 SILICONES — 32-page booklet *What's a Silicone?* describes silicones in terms of what they do. Photos illustrate each application. Dow Corning Corp, Midland, Mich.

(Continued on page 224)

Say good-bye to Tube troubles!

CHASE ANTIMONIAL ADMIRALTY

*(A patented alloy)**



LONG-LASTING because there's enough antimony to resist dezincification.

LONG-LASTING because antimony doesn't affect the grain structure of the metal—won't weaken the tube.

LONG-LASTING because years of tests and actual use of Chase Antimonial Admiralty have proved that the right amount of antimony increases the life of the tube.

Send coupon for Free Book on Condenser and Heat Exchanger Tubes.

CHASE WAREHOUSE STOCKS: *NEW YORK, BALTIMORE, NEW ORLEANS, LOS ANGELES,* also carried by—*Vinson Supply Co., Tulsa; Standard Brass & Mfg. Co., Houston.* *U.S. Pat. No. 2,061,921

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FREE CHASE BOOK discusses corrosion problems and selection of proper alloy for condenser and heat exchanger tubes.

Chase Brass & Copper Co., Dept. PO652
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Please send me Free Book on Condenser and Heat Exchanger Tubes.

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In a Midwestern power company ash handling installation this 8" pump shell of ABK Metal outlasted an alloy steel casting by 2½ to 1.

CUT YOUR ASH HANDLING COSTS

with ABK METAL

Its rugged resistance to abrasion means longer life — fewer replacements of parts and equipment.

For handling wet or dry ashes ABK Metal greatly lengthens the service life of ash pump casings and impellers, ash pipes, elbows and fittings, sluiceway liners, fly ash injector nozzles, wear backs and similar equipment. ABK Metal has outlasted white iron and manganese steel which it replaced, by as much as 7 to 1.

ABK Metal is a nickel-chrome iron alloy with the metallurgical structure controlled to provide maximum abrasion resistance. Over a period of years it has established an outstanding record for economy and long wear under the most severe abrasive conditions.

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Don't let ABRASION steal your power-economy dollars . . .
SPECIFY ABK METAL

ABK METAL fights ABRASION

American Brake Shoe Company

BRAKE SHOE AND CASTINGS DIVISION
230 Park Avenue, New York 17, N. Y.

More FREE BULLETINS

Begins on page 163

B41 **SELF-STICKING PRODUCTS**—Wire markers, pipe markers, safety signs, *Scotchlite* signs, masks, stencils, printed rolltape. 50-page catalog describes full line. Illustrations, photos, prices. W H Brady Co, Dept 393, 1630 E Spring St, Chippewa Falls, Wis.

B42 **CONVEYOR BELT REPAIR** — Plastic rubber compound requires no heat or special machinery, belt is ready for use in 12 hours. 4-page folder gives application, uses, installation photos. Magic Chemical Co, Dept N58, 121 Crescent St, Brockton 2, Mass.

B43 **PLASTIC PAINT**—Corrosion resistant *Corrosite* protects against salt water corrosion, chemical attack, etc. 8-page bulletin 201 describes properties, uses. Corrosite Corp, Chrysler Bldg, 405 Lexington Ave, New York 17.

B44 **OIL RETAINING TREATMENT**—*Rustshield 2* produces oil-retaining rustproof surface for moving metal parts. 4-page folder gives properties, application. Octagon Process, Inc, 15 Bank St, Staten Island 1, N. Y.

B45 **LIQUID STAINLESS STEEL**—Surface coating provides corrosion-resistant surface. 4-page bulletin gives properties, prices. Slip-on, Inc, 401 Broadway, New York 13, N. Y.

B46 **PHENOLIC COATING RESIN**—*Phenoline 300* is corrosion resistant, sets hard at room temperature, needs no baking. 4-page bulletin 600 gives properties, uses, method of application, prices. Carboline Co, 7603 Forsyth Blvd, St Louis 5, Mo.

B47 **ROOF REPAIR** — Renewing, patching, repairing flashings. 16-page bulletin *Saving Old Roofs* gives maintenance methods. Tropical Paint & Oil Co, Cleveland 2, Ohio.

B48 **BUILT-UP ROOFS**—6-page bulletin tells how to lay one- and two-ply roofs. 4-page bulletin gives information on *Halcoloid* roof protection. Hallemite Mfg Co, Cleveland 13, Ohio.

B49 **ROOF COATING** — Asphalt and asbestos coating prevents composition roof from drying out, cracking and leaking. 4-page bulletin L-5201 describes *Seal-Kote* properties, uses. Paramount Industrial Products Co, University Center Station, Cleveland 6, Ohio.

MATERIALS HANDLING

B50 **GRAVIMETRIC FEEDER**—Loss-in-weight type for dry materials, capacities from 1 to 4000 lb per hr. 4-page bulletin 30-H12 describes operation, feed range, components, accessories. Omega Machine Co, 345 Harris Ave, Providence 1, R. I.

B51 **4-ROPE BUCKETS**—For use with overhead or bridge type cranes. 44-page bulletin 2392 gives construction, specifications, applications, diagrams of reeving, cable arrangement, etc. Bucket Dept, Blaw-Knox Div, Pittsburgh 30, Pa.

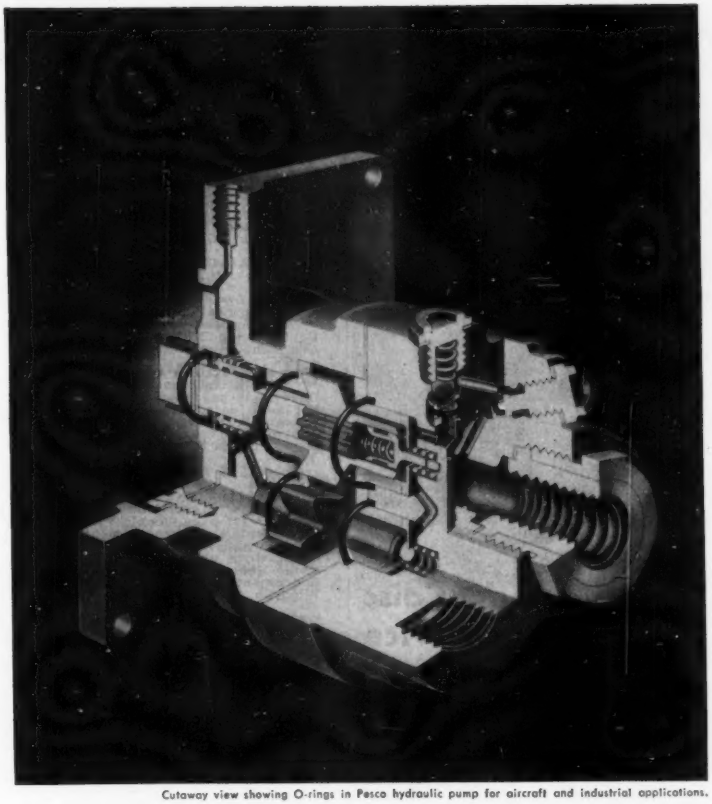
B52 **ELECTRIC TRUCKS**—Survey of complete fork-truck line. 20-page catalog describes *Spacemaster* operation, maintenance, accessories. Lewis-Shepard Products, Inc, Dept R-1, Watertown, Mass.

B53 **STACKERS**—Driver-led, electric *Transtackers*, capacities to 5000 lbs. 2-page bulletin ST-501 Rev gives dimensions, diagrams. Automatic Transportation Co, 149 W 87th St, Chicago 20, Ill.

MECHANICAL TRANSMISSION

B54 **SPEED REDUCERS** — Double worm and helical-worm gear types, reductions up to 6400:1. 48-page bulletin G-WWH gives data on hp, output torque, center distances, also selection, dimensions, photos. De Laval Steam Turbine Co, Trenton 2, N. J.

B55 **V-BELT DRIVES** — Engineering guide No. 50-A gives formulas for



Cutaway view showing O-rings in Pesco hydraulic pump for aircraft and industrial applications.

Simplified Leakproof Seals

WITH PARKER O-RINGS

THIS IS IT

Cross section drawing of O-ring in groove, sealing under pressure.

PARKER synthetic rubber O-rings are simple to use, simple to replace. They require no complicated product design . . . a simple groove is all that is needed. Economical in first cost, they provide perfect, leakproof sealing with economy of weight and space . . . can be used in moving and non-moving applications.

PARKER is the one source for all standard O-rings to meet specifications covering fuel, hydraulic and engine oil services . . . and for special service O-rings of tested and approved compounds. Your Parker O-ring distributor listed at the right will give you Catalog 5100 . . . or write direct to The PARKER Appliance Company, 17325 Euclid Avenue, Cleveland 12, Ohio.

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650 E. Gilbert, Wichita 11, Kan.

CANADA
Railway & Power Engineering Corp., Ltd.

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bronze globe and angle valves . . .

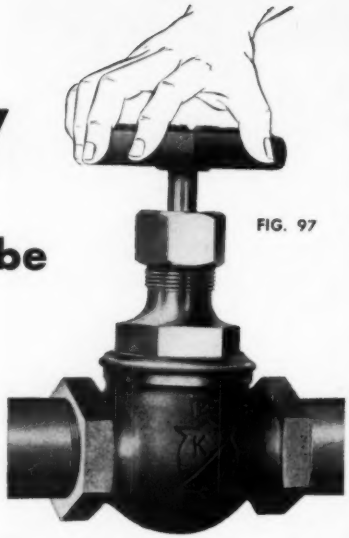

FIG. 97

JOB-FITTED with the *right* disc for every service

FIG. 98

TO ASSURE LONG, TROUBLE-FREE OPERATION with easy maintenance, the complete KENNEDY Line is *job-fitted* . . . every valve specially designed and engineered for the job it has to do.

IN THE KENNEDY FIGS. 97 and 98, for example, the disc is exactly matched to the job. To meet a wide range of fluid, temperature and pressure requirements, a variety of disc materials is available. Each is carefully selected for the service for which it is recommended.

THE RENEWABLE COMPOSITION DISCS give longer service because the extra height of the raised seats utilizes full thickness of the disc before replacement is necessary. The disc holder swivels on the stem to allow uniform wear on the disc.

THE MOLDED PACKING is self-lubricating and both Fig. 97 and Fig. 98 can be readily repacked under full pressure.

THE HEAVY-WALLED BODIES are ruggedly built with full rounded contour. The stems are made with manganese bronze of 50,000 lb. tensile strength and have unusually heavy threads. Parts are fully interchangeable. Sizes range from ¼ to 3 inches with a working pressure of 125 lbs. saturated steam, WRITE FOR BULLETIN 56.

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Est. 1877

THE **KENNEDY**
VALVE MFG. CO. • ELMIRA, N.Y.

VALVES • PIPE FITTINGS • FIRE HYDRANTS

More FREE BULLETINS

Begins on page 163

standard quarter-turn and V-flat drives. Also tables of drives in all belt sections. Fort Worth Steel & Machinery Co, P O Box 1038, Fort Worth, Texas.

METALS AND ALLOYS

B56 PUMP CASTINGS — *Meehanite* metal resists wear, impact, erosion, pressure, corrosion. 20-page bulletin 36 gives specifications, photos of applications. Meehanite Metal Corp, New Rochelle, N. Y.

B57 LEAD-CLAD METALS — 22-page booklet *The History and Development of Ferrolum Lead Clad Steel and Cupralum Lead Clad Copper* gives use of lead in chemical industry, properties and uses of the lead-clad metals. Research Dept, Knapp Mills Inc, 23-15 Borden Ave, Long Island City, N. Y.

B58 PRECISION CASTINGS—*Microcast* investment casting process outlined in 16-page booklet. Composition, hardness data, applications, possible tolerances illustrated. Microcast Div, Austenal Laboratories, Inc, 224 E 39th St, New York 16, N. Y.

METERS AND INSTRUMENTS

B59 INSTRUMENTATION—*Fundamentals of Instrumentation for the Industries.* 126-page booklet 80-2 covers fundamentals of measurement, control and transmission of variables. Gives applications, photos, diagrams. Minneapolis-Honeywell Regulator Co, Brown Instruments Div, Station 40, Wayne & Windrim Aves, Philadelphia 44, Pa.

B60 CENTRALIZED INSTRUMENTATION—Conventional and graphic type panelboards, also the measuring and control instruments used. 32-page bulletin 85-20 gives general picture with photos, typical systems. Minneapolis-Honeywell Regulator Co, Brown Instruments Div, Station 40, Wayne & Windrim Aves, Philadelphia 44, Pa.

B61 POTENTIOMETERS — *Dynamaster* electronic units, also bridge instruments for recording temperature, pH, speed, power, strain, etc. 36-page bulletin P1245 has photos, wiring diagrams, applications. Bristol Co, Waterbury 20, Conn.

B62 FLOW METERS — Open channel type, series 500, for measuring water, sewage, plant effluent, etc., through weirs and flumes. Bulletin F1606 gives description, applications. Bristol Co, Waterbury 20, Conn.

B63 TEMPERATURE - SENSITIVE CRAYONS — Calibrated melting points from 113 to 2000 F, indicate temperature within 1% of rating. 1-page instruction sheet. Tempil Corp, 11 W 25th St, New York 11, N. Y.

B64 BIN-LEVEL CONTROL — Automatic *Tellevel* control switch regulates level of bulk materials or liquids. Normal, explosion-proof and heavy duty units. 4-page bulletin 11-0 gives photos, installation diagrams. Stephens-Adamson Mfg Co, Aurora, Ill.

B65 BIN-LEVEL INDICATORS — For thin or thick walled bins, inside or outside location, and for suspended interior installation. 20-page bulletin gives installation data, dimensions, wiring diagrams. Bin-Dicator Co, 13946-152 Kercheval, Detroit 15, Mich.

B66 COMBUSTION INDICATOR — *Hazegage* indicates best combustion point. Electronically measures haze in smoke stack. 2-page bulletin 801 gives specifications. Ess Instrument Co, Bergenfield, N. J.

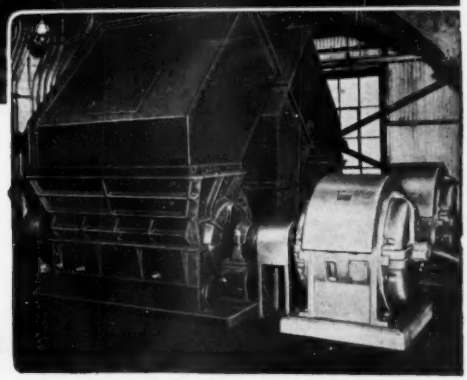
PIPING VALVES FITTINGS AND SPECIALTIES

B67 AIR LINE CLEANER—Mechanical unit removes oil, moisture, dirt from compressed gas and air lines. 8-page catalog 252 gives operation, installations, size selection data. Logan Engineering Co, Aridifier Div, 4901 W Lawrence Ave, Chicago 30, Ill.

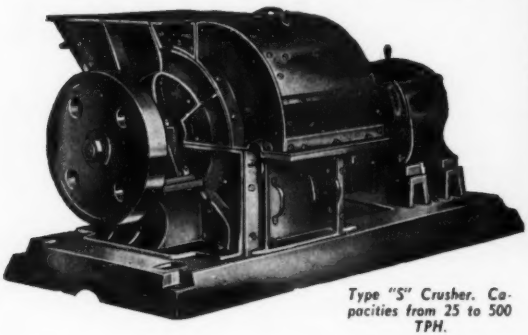
TWIN AMERICAN CRUSHERS PRODUCE 4,000,000 TONS OF CRUSHED COAL IN 6 YEARS

16" ROM Reduced to 3/4" at 900 Tons Per Hour

The Ohio Power Company Tidd Plant at Brilliant, Ohio



Note the compactness of area in which these two direct motor-connected 60S Americans are installed



Type "S" Crusher. Capacities from 25 to 500 TPH.

In commercial service since September, 1945, at the Tidd Plant of The Ohio Power Company, Brilliant, Ohio, the twin American 60S Crushers shown in the installation above have reduced 4,000,000 tons of 16" run-of-mine bituminous coal to a ¾" product.

Even with this record, these crushers—each rated at 450 tons per hour—were not fully loaded until November 1, 1948, when the plant started commercial service of its second turbo-generator.

CRUSHERS NOW HANDLING 420,000 TONS PER UNIT PER YEAR

Close to half a million tons per unit . . . the dependable, uniform, high tonnage at The Ohio Power Company plant is typical of American performance. Rugged Americans are producing unfailingly at other plants throughout the world, too—offering a *complete* once-through crushing plant in *one compact unit.*

Get the full details on efficient power plant coal reduction.
WRITE for Bulletin "CRUSHING COAL AT LESS THAN 1¢ PER TON"

American PULVERIZER COMPANY

Originators and Manufacturers of Ring Crushers and Pulverizers

1349 Macklind Ave.
St. Louis 10, Mo.

Close-up view of leaf-type filter used with Sorbo-Cel by Pullman-Standard

How Pullman-Standard operates boilers on a

1% blow-down basis...

with SORBO-CEL

At the Haskell & Barker plant of Pullman-Standard Car Mfg. Co., Sorbo-Cel solved the major filtration problem of removing oil from condensate returned to the two new 50,000 lb-per-hr 400 psi, 750-F boilers.

Pre-Coat Sorbo-Cel and regular Sorbo-Cel, specially processed high flow-rate diatomaceous silica powders, are used on leaf-type filters. After a film of Pre-Coat Sorbo-Cel has been built up on the filter screens, regular Sorbo-Cel is added continuously to the unfiltered water. This means a new filter surface is constantly presented to the oncoming water.

Results . . . Water filtered by Sorbo-Cel contained less than 0.1 ppm of oil . . . and boilers have since been operated on a *one per cent* blow-down basis.

Send coupon below for bulletin giving data on this low-cost way to remove oil from water. No cost or obligation.

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SORBO-CEL

Johns-Manville
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Please send me free bulletin giving advantages of Sorbo-Cel filtration.

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Company_____

Address_____

City_____ State_____

APPOINTMENTS

New Corporation Executives

Dr George V Slottman is vice-president, **Air Reduction Co, Inc,** and continues as director of research and engineering. A P Davis, back from an early retirement, is president of **Arma Corp.**

Hugo W H Wellington becomes vice-president of **Boston Edison Co,** in charge of steam and electric operations. Alva L Cremean is now vice-president in charge of manufacturing at **Bunting Brass and Bronze Co.** John K Beidler is a director of **Dravo Corp.**

David S Williams takes over as president of the **Graton & Knight Co,** succeeding his father Arthur A Williams, who is chairman of the board. At **Combustion Control Corp,** Burton E Shaw is vice-president and general manager. Henry T Sulcer becomes vice-president at **Graver Tank & Mfg Co, Inc.**

W A Jones Foundry & Machine Co, elects Thomas A Jones president, Frederick H Hoge chairman of the board, Robert B Moir vice-president in charge of engineering, Joseph A Marland vice-president and manager of sales and service, James B Christerson vice-president and treasurer, Robert E Whiteway secretary and production manager.

Johnson Service Co has elected J S O'Gorman Jr a director, J R Vernon, Paul Gayman and K A Wright vice-presidents, L V Zacharyasz secretary and assistant treasurer, and Herbert H Koepke assistant secretary and personnel manager.

J S Roscoe and G E Tenney are additional members of **Lincoln Electric Co's** board of directors. John J Radigan Jr becomes vice-president in charge of industrial relations at **P R Mallory & Co, Inc.** E D Youmans is member of board of directors of **Okonite Co.**

Philip T Sharples is a director of **Philadelphia Electric Co,** filling vacancy created by retirement of Henry B Bryans. At **Hewitt-Robins Inc,** new executives are Benjamin T Moffatt, executive vice-president; Harold Von Thaden vice-president and general manager of the International and Robins Engineers divisions; Austin Goodyear general manager of Hewitt Rubber and Robins Conveyors divisions; Robert A Nilsen general manager of the Restfoam division.

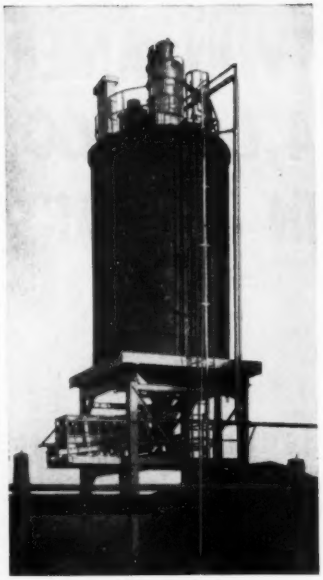
W F Mainguy is executive vice-president, A C Abbott vice-president, distribution, Jules Bouchard manager of commercial and distribution department and Raymond Dupis a director at **Shawinigan Water and Power Co.**

Morse G Dial becomes president, Walter E Remmers vice-president, Alloys division, and Kenneth H Hannan treasurer of **Union Carbide and Carbon Corp.** New vice-presidents at **Aluminum Co of America** are Gordon W Cameron, Arthur P Hall, and C F Nagel Jr.

Donald G Fink joins **Philco Corp** as co-director of research-operations.

New Operations Executives

Charles E Bain Jr is manager of manufacturing at **American Pulley Co.** Lee Fraser takes over as production manager



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Dependable Low Cost Ash Removal

A survey of your plant by a NATIONAL engineer may reveal that ash removal costs are cutting your profit margin. A survey will cost you nothing . . . may very well boost your earnings.

NATIONAL PNEUMATIC STEAM ASH REMOVAL SYSTEMS

add to the efficiency of your plant in two ways —

1. Exceptionally easy one-man operation means minimum labor cost.
2. Rugged NATIONAL construction means maximum life for parts . . . surprisingly low maintenance costs.

It will pay you to investigate NATIONAL'S reputation for delivering satisfaction . . . its complete and effective service policy. Ask us for full information.

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Manufacturers of The National ChipVeyor System For Metal Turnings – Furnace Doors – Feeders – Ash Gates and Related Equipment.

BRONZE "QUICK-FLO" QUICK OPERATING LEVER GATE VALVE

BRONZE QUICK OPERATING LEVER GATE VALVES

Fig. 131—200 lbs. W.S.P. 300 lbs. W.O.G. ½" to 3"

Fig. 130—100 lbs. W.S.P. 150 lbs. W.O.G. ½" to 4"

Fig. 736—125 lbs. W.S.P., 200 lbs. W.O.G. ⅜ to 3". Also listed as standard by Underwriters' Laboratories. Approved by Factory Mutual Laboratories for use on devices handling gasoline, naphtha, fuel oil, etc. at a maximum working pressure of 50 lbs. Be sure to specify service.

Fig. 835—125 lbs. W.S.P. 200 lbs. W.O.G. ⅜" to 3". Approved by Factory Mutual Laboratories for the handling of gasoline, lacquer thinners, and similar liquids at a maximum working pressure of 50 lbs. Be sure to specify service.

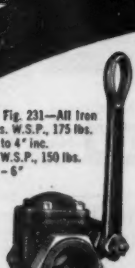

Fig. 328—Iron Body Bronze Mounted. 125 lbs. W.S.P., 175 lbs. W.O.G.—1 to 4" inc. 100 lbs. W.S.P., 150 lbs. W.O.G.—5 - 6"

Fig. 231—All Iron 125 lbs. W.S.P., 175 lbs. W.O.G.—1 to 4" inc. 100 lbs. W.S.P., 150 lbs. W.O.G.—5 - 6"

BRONZE "QUICK-FLO" SELF CLOSING LEVER GATE VALVE

IRON BODY QUICK OPERATING LEVER GATE VALVES

Fig. 132—Iron Body Bronze Mounted. 175 lbs. W.S.P., 250 lbs. W.O.G.—2 to 4" inc. 150 lbs. W.S.P., 200 lbs. W.O.G. 5 - 6"

Which of these 7 QUICK OPERATING VALVES *fits your needs*

D. T. Williams offers you a complete line—from general purpose types to those that are self-closing, Underwriters' Laboratories listed or Factory Mutual approved. All are faultlessly engineered, quick and dependable in operation!

See your nearest jobber or write for literature.

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BIDDLE

NUMBER 5 OF A SERIES

Instrument News

ARE YOU SURE OF PROTECTION THROUGH YOUR GROUND CONNECTIONS?

Biddle Ground Tester measures low resistance

Photo Courtesy Copperweld Co.

In spite of apparently good lightning rod or arrester protection, lightning frequently will cause severe damage if high ground resistance hampers its dissipation in the earth. Lightning storms are prevalent in the northeastern states during the spring and fall months. Plants in this section should make a thorough round of ground resistance tests. Aside from the hazards to personnel, thousands of dollars may be saved in damage to electrical equipment and in loss of power and stoppage of production.

The MEGGER® Ground Tester is the easiest, quickest and most accurate method of determining ground resistance. It is an instrument specially designed for the purpose and should be used wherever possible. Direct readings are automatically obtained in ohms. It provides its own source of current—no batteries, or other remote source required. It's easy to carry, too. Has approval of the Associated Factory Mutual Insurance Companies.

Don't put it off—write today for "Grounding Electrical Circuits Effectively" by J. R. Eaton (Bulletin 25T2-P) and our Biddle manual on "Ground Resistance Testing" (Bulletin 25J-P).

HERE'S A "GOOD COMPANIONS" KIT FOR PRACTICAL ELECTRICAL ENGINEERS AND MAINTENANCE MEN

Men concerned with all-around-the-plant electrical tests and resistance measurements tell us that these are "indispensable" tools:

Midget Megger Electrical Insulation Tester for detecting dirt, moisture and deterioration in advance of failure, or as a trouble-shooter after failures occur.

The Midget Megger Circuit Testing Ohmmeter for measuring conductor resistance of coils, contacts and relays, and checking continuity of circuit and grounded parts.

Be sure to write for your copy of our **new Bulletin 21-85-P today.**

JAMES G. BIDDLE CO.
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ELECTRICAL TESTING • SPEED MEASURING INSTRUMENTS • LABORATORY & SCIENTIFIC EQUIPMENT

More APPOINTMENTS

Begins on page 228

of **Arma Corp.** A F Koch is works manager of **Borg-Warner Corp's** newly formed Wooster Division at Wooster, Ohio.

Andrew Liston is appointed general manager of the tank hull department, Eddystone Division, **Baldwin-Lima-Hamilton Corp.** A H Jackson becomes manager of the tower department of **Blaw-Knox Co,** succeeding E J Staubitz who has retired. J S Beecher is in charge of proposals and general technical work, and Charles Clodi in charge of the water laboratory of the power chemicals division, **E F Drew & Co, Inc.**

Joseph T Bailey is manager of marketing, F Wiley Hubbell, manager of finance; Wm F Oswalt, manager of manufacturing, and Hal W Poole, manager of engineering at **General Electric Co's** new industry control department. In GE's appliance control dept, Phillip Gomez Jr becomes manager of sales, Arnold Dunn manufacturing engineer, James M Clark manager of finance, Alden L Thomas superintendent of the Morrison plant, Thomas J Kelly design engineer, and James H McDuffie supervisor of personnel.

J T Cataldo is appointed assistant general manager of **International Rectifier Corp.** Donald E Beaton becomes assistant general manager, hydraulic division, **Twin Disc Clutch Co.** Harold C Erskine is now assistant division manager of die casting operations, and H J Morrison manager of the Cleveland works, **Aluminum Co of America.**

Engineering Appointments

Perry G Snyder is appointed Youngstown district engineer for **Youngstown Sheet and Tube Co.** A W Keen is manager of application coordination of **Sylvania Electric Products, Inc.** Edwin H Keiper is chief engineer of the **Pennsylvania Crusher Co.**

Alan Howard is manager of the engineering department, and John P Keller general manager of the gas turbine department in **General Electric Co's** turbine division. Wm E Miller becomes manager of the steel mill section of GE's industrial engineering department.

Frank A Brede joins **Graton & Knight Co** as chief engineer, transmission and development, in the research and development department. R B Willi is chief engineer, Southwark operation of the Eddystone Division of **Baldwin-Lima-Hamilton Corp.** John L Michaelis is a contracting engineer at **Heyl & Patterson, Inc.**

R K Cross is representative to the U. S. Army for **Arma Corp.** John H Crankshaw becomes executive engineer with both **J A Zurn Mfg Co** and **American Flexible Coupling Co.**

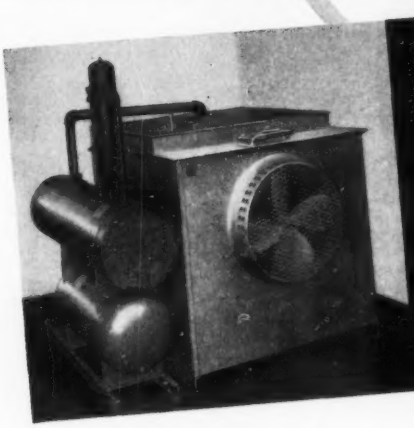
W F Dueringer is appointed engineer-in-charge of sales of the steam turbine section; C R Bloom, supervisor of sales of units 15,000 kw and larger; J T Donovan supervisor of sales below 15,000 kw; and D J Nairn supervisor of sales of marine and navy turbine equipment for **Allis-Chalmers Mfg Co.**

(*Continued on page 232*)

New

SAVES WATER and CUTS MAINTENANCE COSTS . . .

Illustrations show two views of a 35 ton Condenser Tower prior to partial disassembly for shipment.



Vogt

CONDENSER TOWER

FOR CONDENSING REFRIGERANTS

SINGLE RESPONSIBILITY:

Vogt, leading builder of refrigeration condensers, assumes responsibility for engineering the unit. Only one purchase order needed.

SHOP FITTED:

To cut down field assembly labor. Requires no cutting or fitting of pipe.

Designed for today's water conservation requirements, and to keep refrigeration costs low, the *new* Vogt Condenser Tower meets the need for a proven, readily cleanable condensing unit.

The Vogt Condenser Tower consists of a multipass straight tube condenser, a receiver, an oil trap, a cooling tower, and a water pump. Removable cast iron heads permit easy cleaning of the condenser tubes.

Water costs are extremely low since the cooling water is recirculated continuously and requires only a small amount of makeup to replace losses due to windage and evaporation.

Condenser Tower units are available in capacities ranging from 5 to 50 tons refrigeration. Additional information will be furnished upon request.

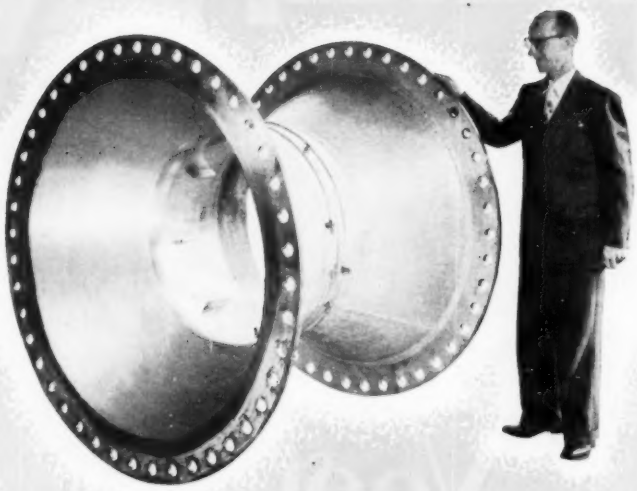
HENRY VOGT MACHINE CO., Louisville 10, Kentucky

BRANCH OFFICES: NEW YORK, PHILADELPHIA, CLEVELAND, CHICAGO, ST. LOUIS, DALLAS, CHARLESTON, W. VA.

FOSTER FLOW TUBES

(Gentile Patents)

Are EASIER to Install



This 48" Foster Type D Flow Tube, of lightweight fabricated steel construction for measuring flow of air in the discharge line of a reactor air system, flanged for 125#, is only 48" in length between flanges and weighs only 1350 lbs.—many feet shorter and several thousand pounds lighter than a conventional venturi.

In addition to being considerably easier to handle, the Flow Tube takes up but little space, and needs no straight entering run for normal accuracy, except before and after valves in which case eight diameters are required upstream and five diameters downstream. This means that the Flow Tube can be installed without expensive vaults or housing in any readily accessible point where flow conditions are reasonably steady.

This Flow Tube, one of many for top priority defense projects, was designed to handle 29,300 SCFM at 10.12 PSIA at 238°F with a maximum head loss of 2" H_2O and with an accuracy within ±1% of the calibration curve furnished with it.

Foster Flow Tubes are made for a wide range of services metering the flow of liquids and wet or dry gases. They are available in all commercial pipe sizes, with screwed or flanged connections, bell and spigot, or welding ends, and of any materials required by the service. For further information on Flow Tubes, ask for Bulletin FT-101; and if you would like specific recommendations, please give us processing and installation details of your metering requirements.

FOSTER ENGINEERING Company

835 Lehigh Avenue • Union, N. J.

PRESSURE REGULATORS . . . RELIEF AND BACK PRESSURE VALVES . . . CUSHION CHECK VALVES . . . ALTITUDE VALVES . . . FAN ENGINE REGULATORS . . . PUMP GOVERNORS . . . TEMPERATURE REGULATORS . . . FLOAT AND LEVER BALANCED VALVES . . . NON-RETURN VALVES . . . VACUUM REGULATORS OR BREAKERS . . . STRAINERS . . . SIRENS . . . SAFETY VALVES . . . FLOW TUBES

More APPOINTMENTS

Begins on page 228

W H Hawkins retires as senior assistant engineer in the office of the **Commissioner of Penitentiaries,** Ottawa. C Harry Anderson becomes operating superintendent of the Western division of **Niagara Mohawk Power Corp,** succeeding Harold R Waldron who has retired.

Sales Appointments

Wayne G Slife is new sales engineer in the Dallas, Tex., office of the heavy machinery division, **Nordberg Mfg Co.** Emile Estoclet takes over as regional manager of the industrial division of **York-Shipley, Inc,** for eight eastern states. Harold H Burrows is sales manager of the industrial rubber goods sales division, **Raybestos-Manhattan, Inc.**

Harold F Holtz becomes sales manager of the boiler division for **Cleaver-Brooks Co.** John F Byrom is sales engineer, railway division at Minneapolis for **Timken Roller Bearing Co.** Harry Beach covers the Pennsylvania-New Jersey area for **Flexible Steel Lacing Co.**

Vincent P Oatis Jr is industrial sales manager, assisted by Wm A Mallory and George E Placier Jr at the Pittsburgh office of **National Electric Products Corp.** Wm T Harris is assistant to the Southern district commercial sales manager of **York Corp.**

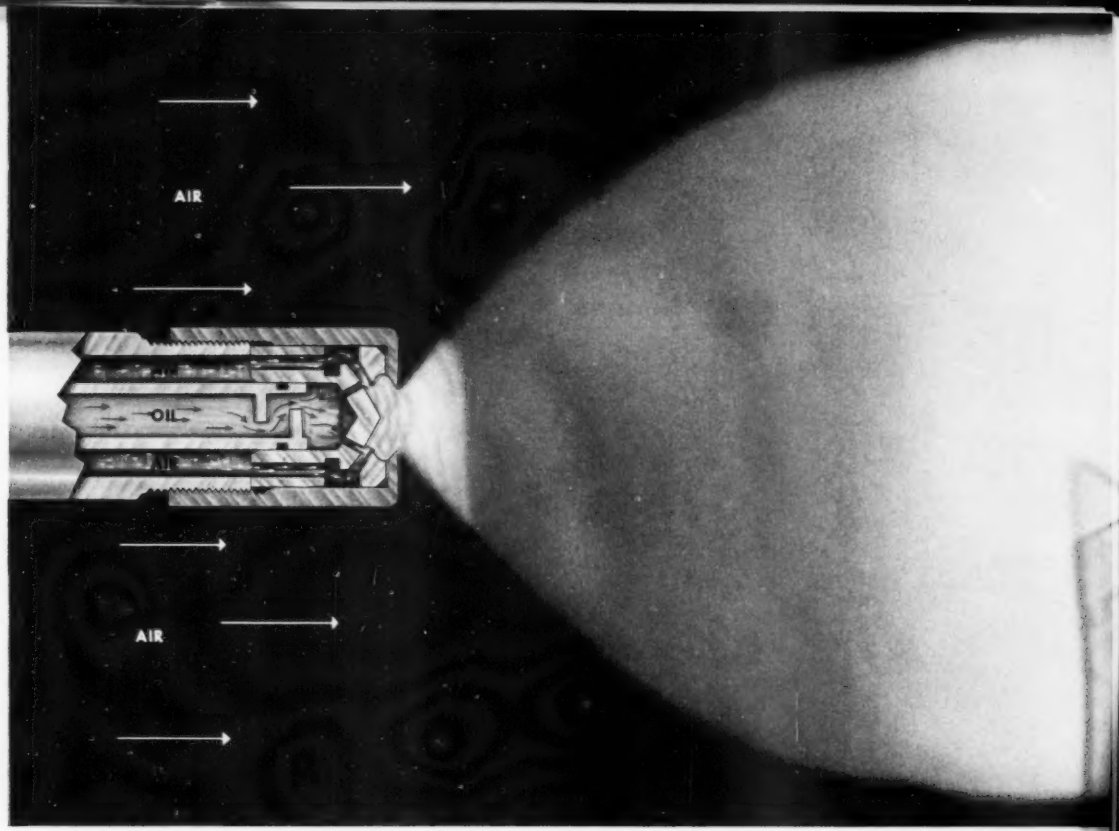
Harry M Freeker manages commodity sales for the mechanical goods division, and Gerald L Dennis is branch manager of the West Coast operations of Naugatuck Chemical Division of **United States Rubber Co.** D Leete Keefer transfers to Philadelphia as technical representative, Wm J Curtin is technical representative in Naugatuck, and Lawrence H Bruce assistant to the sales manager for the Naugatuck Chemical Division.

Morris S Palmer becomes manager of field sales and Raymond F Attner, Hancock valves product manager for **Manning, Maxwell & Moore, Inc.** Raymond C West is Gulf Coast district manager, and George F Bright is Mid-Continent district manager.

Wm H Steinkamp becomes sales manager, and O B Wilson field sales manager for the Industrial division of **Minneapolis-Honeywell Regulator Co.** New sales engineers for the division are Harry R Nichols and Edward J Roach, East Orange, N.J.; John J Heavey, Syracuse; John M Caylor, Harrisburg, Pa.; Jack M Fettig, Donald C Roberge and John C Sharp, Detroit; Vendel W Immel, Saginaw, Mich.; Alexander W Spears, Pittsburgh; Axel H Magnuson, D J McDowell, and Harry W Spongberg, Chicago; and Wilbur J Smith, Milwaukee.

Also, Robert D Werckle, Peoria; Leland K Smith, Davenport; John S Hafling, Louisville; Glenn Cullen, Billings, Mont.; Richard W Polgreen, St Paul and Minneapolis; John H Tenison, Houston; Calvin L Perilloux, New Orleans; Robert W Smith, Kansas City; Jack T Teed, Tulsa; Max R Curtis, Salt Lake City; Richard E Roberts and Roland T Williams, Los Angeles; and Harvey L Tibbals, San Francisco.

Robert J Baumann is sales manager of



NOW—only Powermaster gives you VORIFLOW combustion!

LATEST DEVELOPMENT IN BURNER DESIGN REDUCES COSTS AND INCREASES BOILER EFFICIENCY

Here's what *Powermaster's* new VORIFLOW burner will do for you:

1. Saves fuel by providing infinitely variable combustion modulation in response to demand—with *full efficiency*—through wide range from 30% to 100% of firing capacity.

This means elimination of waste and maintenance headaches because of incomplete combustion. With the exclusive design of the VORIFLOW burner, tiny jets of compressed air pulverize every droplet of oil . . . projecting a fine fog of oil/air emulsion into the combustion area where it ignites and burns —immediately and completely. The VORIFLOW burner does away with outmoded mechanical spinning devices, globules of wasted oil, and gummy cleaning problems.

2. Slashes boiler maintenance costs.

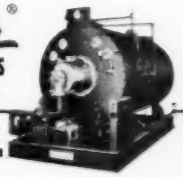
There are *no* moving parts to wear out • There is *no* cup to clean daily. Routine cleaning of the burner once a month is sufficient • There is *no* burner vibration to throw adjustments "out of whack" • Parts are made of stainless steel, brass, and beryllium copper—they will last indefinitely.

3. The combination burner permits rapid change-over from one fuel to another—light oil, heavy oil, or gas.

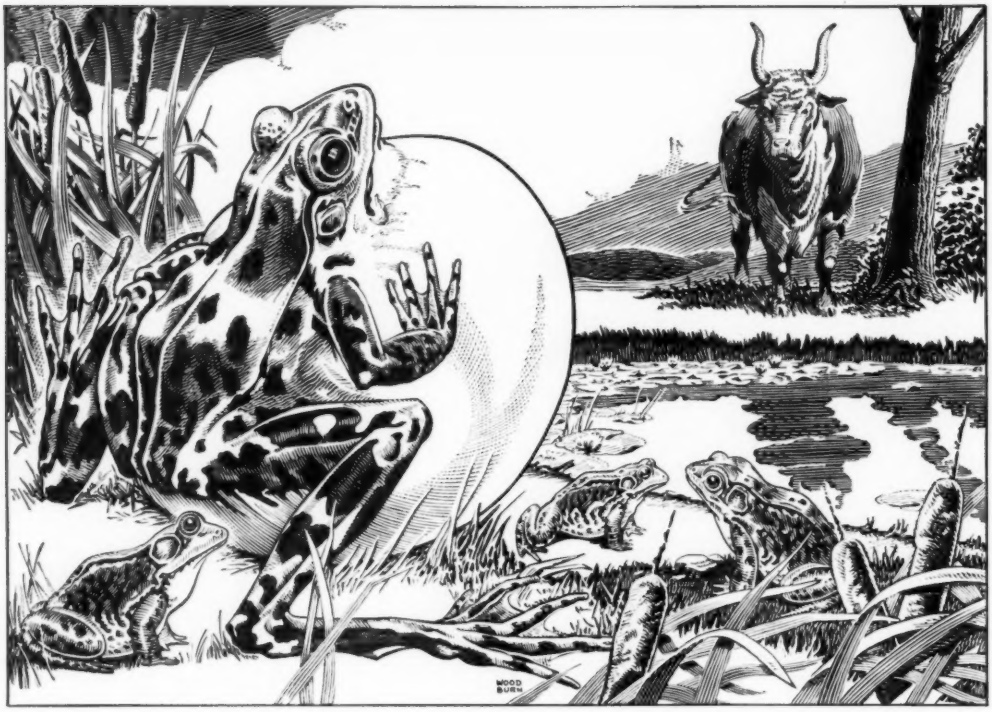
And when we say "rapid" we mean just that—the job can be done in four minutes. Modulating firing controls are ready to go into action at the flick of a switch. It isn't necessary to change the entire burner assembly. All you need to do to fire gas is to remove the oil nozzle.

Before deciding on a boiler for your plant, be sure to get the facts on the newest POWERMASTER with VORIFLOW combustion. Write for this catalog that gives you the entire story of the *Powermaster* packaged automatic boiler. Just drop us a line and we'll put one in the mail for you.

Powermaster®
PACKAGED AUTOMATIC BOILERS
In sizes to 500 HP; pressures to 250 psi



ORR & SEMBOWER, INC. • Established 1885 • **1000 Morgantown Road, Reading, Pennsylvania**



"It's foolish to try to be bigger than you are"

REMEMBER Aesop's fable of the frog and the ox? Told 2,500 years ago, it goes:

"Three young frogs cried to their mother that a little brother had been trampled by the largest beast in the swamp. 'Oh, no,' said the mother, 'no beast is larger than I.' And she blew herself up to show how big she really was. 'But it was much bigger,' the little ones chorused. Whereupon the vain mother inflated herself until she burst." And the moral was, "It's foolish to try to be bigger than you are."

Aside from the wisdom of the fable for each of us individually, there is solemn warning for us as a nation. Some among us seem to believe that with an unlimited supply of taxpayers' dollars America can buy anything--ease and security at home, acceptance of our ideas abroad, friendship of other peoples, even world peace.

Like the vain frog, America inflates herself more and more dangerously, trying to stretch herself to be the biggest thing in the swamp. Meanwhile the enormous beast that is the world goes its own way, scarcely affected by the vainglorious display of America's inflation. It's the same old world that was indifferent before the pomp of Egypt, Persia, Greece and Rome.

How will our present "puffing" end? Isn't it obvious that continued inflation can bring disaster? Only by a realistic policy of living within our means--not trying to be bigger than we are--can America avoid the catastrophe of Aesop's foolish frog.

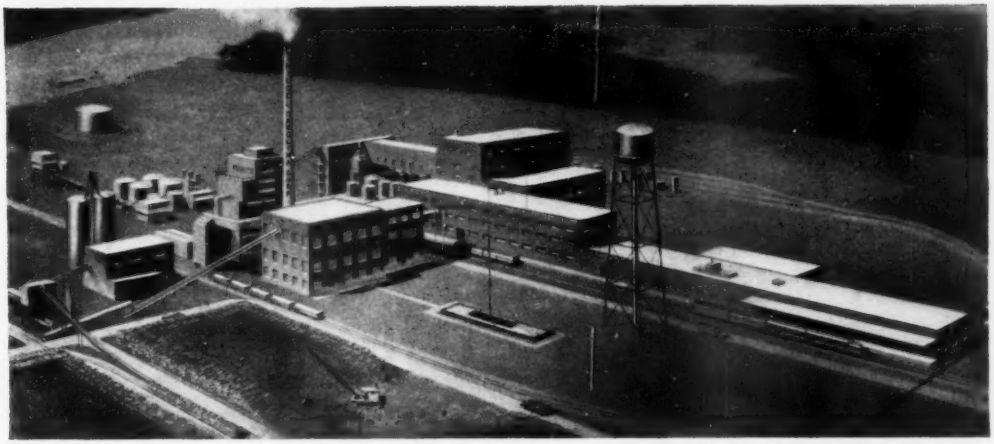
YOUR SCRAP V YOUNGSTOWN IS NEEDED

The Youngstown Sheet and Tube Company

General Offices--Youngstown 1, Ohio
Export Offices--500 Fifth Avenue, New York

MANUFACTURERS OF CARBON ALLOY AND YOLOY STEELS

The steel industry is using all its resources to produce more steel, but it needs your help and needs it now. Turn in your scrap, through your regular sources, at the earliest possible moment.



71 Ingersoll-Rand Pumps installed at

Riegel-Carolina's New Pulp Mill

Ranging in size from ¾ to 400 hp, they serve throughout plant

Riegel-Carolina Corporation's new 20 million dollar bleached kraft specialty pulp mill at Acme, N. C. is being rushed to completion and is scheduled for full-scale operation early this year. The 45-acre site will produce 200 tons of bleached sulphate pulp daily from pulpwood grown on the company's holdings in the nearby Waccamaw forest. Modern in every detail, this new mill takes advantage of all the recent economies developed in the production of bleached kraft pulp.

Ingersoll-Rand pumps serve in practically every phase of the pulp producing process, handling stock of varying consistencies, black liquor, bleach chemicals and general service water. They range in size from Motorpumps of ¾ horsepower to 400 horsepower boiler feed units. The latter are ultra-modern Class HMTA 6-stage pumps, designed with a Unit-Type rotor assembly for sustained high efficiency and easy maintenance.

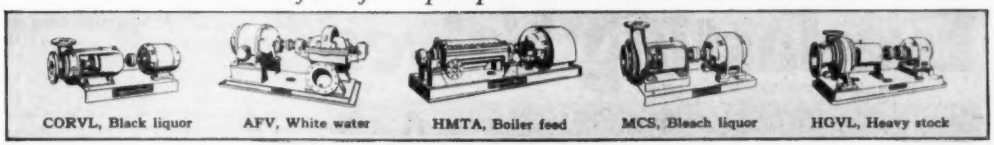
Modern pulp and paper mills can find the best solution to their varied pumping problems in Ingersoll-Rand's complete pump line. An experienced field engineer will be glad to study your problems and make his recommendations for efficient, dependable pumps to suit your particular process.

Ingersoll-Rand

Cameron Pump Division 740-10
11 Broadway, New York 4, N. Y.

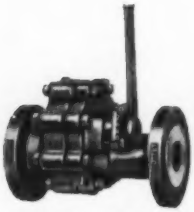
PUMPS • CONDENSERS • COMPRESSORS • DIESEL ENGINES
VACUUM EQUIPMENT • AIR AND ELECTRIC TOOLS

Here are a few of the pumps installed and their services:



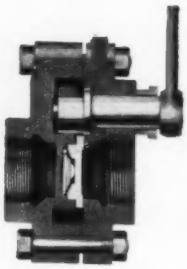
EVERLASTING VALVES

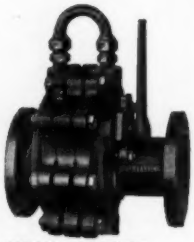
mean "Everlasting" Protection on these duties



GENERAL SERVICE

Wherever frequent use and quick operation is required for any liquid or gas at pressures up to 300 psi. These valves have outside stuffing box and gland.





STEAM JACKETED

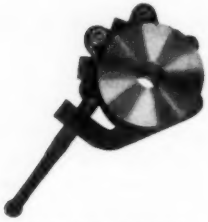
Assure continued free flow of any material which congeals at ordinary temperatures.

FIRE PROTECTION

Closing type for inflammable liquid emergency shut-off, or opening type for deluge or drainage, assuring immediate and positive action with weighted pendulum stop.

BOILER BLOW-OFF

Quick-opening, also hand wheel operated, Angle and "Y" types meeting ASME Code requirements for pressures up to 600 psi.



BOILER WATER COLUMN

With indicator and locking device. Meets ASME Code requirements.

EVERLASTING FEATURES

For more than 40 years, EVERLASTING VALVES have been known for their ingenious design, simple sturdy construction, and long trouble-free life with low maintenance expense. Some of their distinctive features are:

Quick Action . . . opened or closed with less than a quarter turn of the operating lever.

Straight-Through Flow . . . the disc cannot become loose and accidentally check the flow.

Drop-Tight Seal . . . constant contact of disc and seat at all times prevents dirt or scale from getting between.

Self Regrinding . . . the disc rotates on the seat with each operation, thus regrinding the sealing surfaces.

No Wedge Action . . . all parts move between parallel faces.

Write for bulletin describing EVERLASTING VALVES in detail.

EVERLASTING VALVE COMPANY, 49 Fisk Street, Jersey City 5, N. J.

Everlasting Valves

TRADE MARK "EVERLASTING" REG. U.S. PAT. OFF. EV-350

FOR EVERLASTING PROTECTION

More APPOINTMENTS

Begins on page 228

silicone products for **General Electric Co's** chemical division. Dale L Bunday joins the GE electronics division as district sales manager for communication equipment, with headquarters in Oklahoma City, Okla.

T A Miller becomes coordinator and Frank Keenan manager of sales at Trenton headquarters of **Gould-National Batteries, Inc.** New regional managers are O W Rider in Pittsburgh, John P Kelly in Detroit, and Malcolm Janis in New York. Stanley J Mahurin is San Francisco district manager.

David Hughes joins the industrial sales staff of **Simpson Electric Co.** Sam O Dittenhoefer is sales engineer in Chicago for Kaylo division of **Owens-Illinois Glass Co.** Anthony J Allen becomes Eastern sales manager for **Wall Colmonoy Corp.**

Charles T Hall takes over as Philadelphia district manager, and T C McCarthy assistant sales manager for **American District Steam Co, Inc.** Robert M Whitney is sales manager for **Automatic Transportation Co.**

New Sales Offices

Sterling Electric Motors, Inc, opens new offices at 1658 Roundhill Rd, Baltimore, Md., in charge of E Stephen Farlow; 63 Liston Rd, Buffalo 17, N.Y., in charge of J W Byrnes; 319 Castle Blvd, Tulsa, Okla., in charge of B G Jordan.

Sola Electric Co opens branch office at 246 Walnut St, Newtonville (Boston), Mass., with John B O'Donnell as sales representative.

Airtemp Division of **Chrysler Corp** moves its regional sales office from Cleveland to Pittsburgh. John E Craig is manager; new district representatives are Stanley R Kelly, Arthur E Struck, and Keene L LeVan.

Hewitt-Robins Inc have opened an additional office in the Porter Bldg, 106 W 34th St, Kansas City, Mo., in charge of Robert E Crane, field engineer.

New Distributors

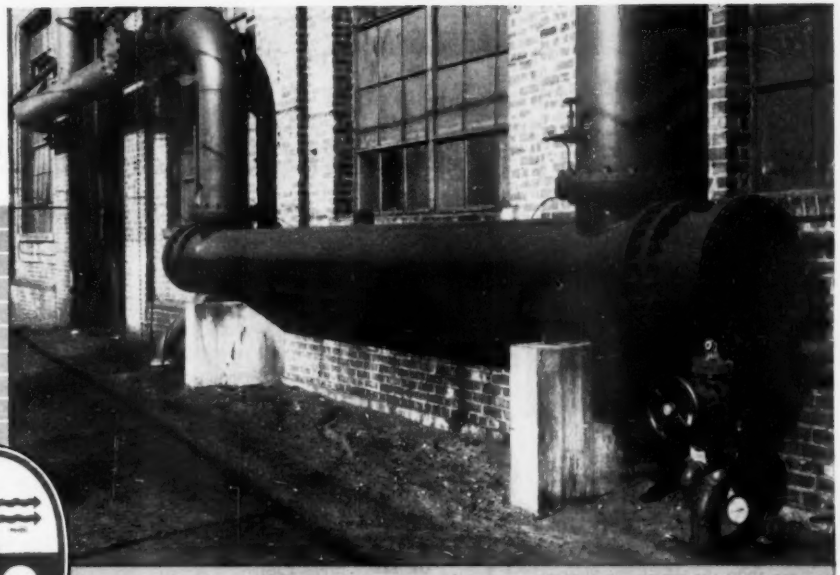
Zurn Services, Inc appoints John B Foley Co representative for their industrial division products in eastern New York State.

Royalton Co, Inc appoints these sales representatives for high pressure industrial pumps: O'Shea Engineering Co, Atlanta, Ga.; I G Downs Co, Denver, Colo.; Cross Pump & Equipment Co, Charleston, W. Va.; Roy A Stipp, Greenville, S. C.

Nordberg Mfg Co, names Overvold Distributing, Inc, 13 Fourth St, Moorhead, Minn., distributors in the Dakotas, northwestern Minnesota, northern Nebraska, and eastern Montana and Wyoming.

Conoflow Corp appoints Equipment Sales Corp, 341 W Market St, Kingsport, Tenn., representative in eastern and central Tennessee and southwestern Virginia.

Cleaver-Brooks Co announces that Dyke & Tutsch Co, 3253 North Green Bay Ave, Milwaukee 12, Wis., are manufacturer's representatives for boiler equipment.



Installation of B & G Gas Cooler

Hydro-Flo HEAT EXCHANGERS

invite your critical appraisal of design and workmanship

Whether you require equipment of standard design or specially engineered units, B & G *Hydro-Flo* Heat Exchangers will stand up under any measurement of value you can apply. They are the sum of both practical field experience and continuous laboratory research and development.

The sound design of B & G *Hydro-Flo* Heat Exchangers is translated by modern manufacturing methods into units of proved efficiency . . . built to do the job well over a long operating life. The line is comprehensive—covering the numerous applications of heat exchangers in modern industrial plants.

The B & G engineering staff is always available for consultation on your heat transfer problems.

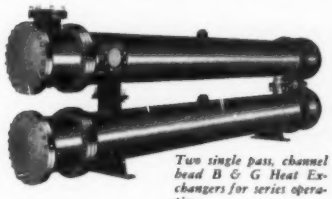
B&G Hydro-Flo shell-and-tube heat exchangers are available in the following types:

Straight and "U" Bend Tube Heat Exchangers . . . Fuel Oil Preheaters . . . Tank Suction Heaters . . . Aftercoolers . . . Gas coolers . . . Water Heaters . . . Refrigeration Evaporators and Condensers . . . Quench Oil Coolers.

BELL & GOSSETT
COMPANY

Dept. CN-36, Morton Grove, Ill.

Canadian Licensee: S. A. Armstrong, Ltd., 1400 O'Connor Drive, Toronto, Canada



Two single pass, channel head B & G Heat Exchangers for series operation.

High pressure B&G Heater with fixed tube sheets and expansion joint design.

B & G CENTRIFUGAL PUMPS
A complete line for industrial application and refrigeration or air conditioning installations. Send for catalogs.

for
custom-engineered
POWER

look to... EP

Since 1909, the job of The Electric Products Company has been to create and develop special electrical rotating equipment . . . motors and generators to do existing jobs better or to reach into new fields to do jobs that couldn't be done before. The natural "by-product" of our more than 40 years of specialization is that you get equipment designed and built to the exact requirements of your application . . . equipment that has greater dependability, longer life and that requires less maintenance.

Send in the coupon below for detailed information about our Custom-Engineered synchronous motors and generators . . . d-c motors and generators . . . induction motors . . . battery chargers . . . frequency changers.

A nation-wide sales engineering and service organization stands ready to meet all User requirements.

THE ELECTRIC
PRODUCTS COMPANY

1717 CLARKSTONE ROAD
CLEVELAND 12, OHIO

Attach coupon to your letterhead for your copy of Bulletin 2-200

NAME_____
TITLE_____
COMPANY_____
STREET_____
CITY_____ ZONE___ STATE_____
2-96

This Plant Claims Their

HEAT SAVINGS PAID
for NICHOLSON TRAPS

Nicholson expansion steam traps were installed by a processor on tank heaters and coils where various unit temperatures from 160° to 185°F were to be maintained. The steam temperature was 320°F. Figuring the difference in heat loss between traps discharging condensate at 160° and others discharging it at approximately steam temperature, they feel the loss was cut nearly in half. On this basis Nicholson expansion steam traps are paying for themselves in many industries.

For All Equipment Using Steam or Hot Water

CATALOG 751 OR SEE SWEET'S

Radiators
Separators
Paper Machinery
Pipe Coils
Kettles
Railway Coaches
Dry Kilns
Vulcanizers
Switch Heaters
Laundries
Molding Presses

125 Oregon St., Wilkes-Barre, Pa.

W. H. NICHOLSON & CO.
TRAPS · VALVES · FLOATS

Coming June 15:

the 1952

POWER BUYERS' GUIDE

- Lists more than 1,000 firms that make power-field equipment. Tells you where they are and what they make
- Reviews new equipment. Makes it easy for you to send for catalogs and bulletins
- Brings you up-to-date on changes among manufacturers

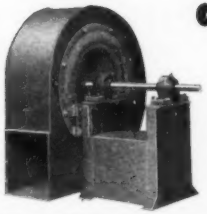
Here's one issue you'll want to keep within arm's reach, the year 'round.

HEADQUARTERS FOR AIR HANDLING AND CONDITIONING EQUIPMENT

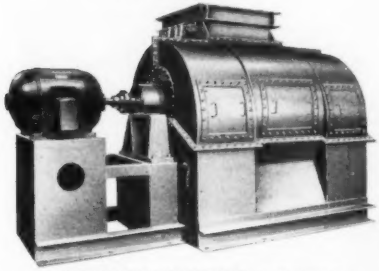
. . . . to meet all types of industrial, power plant, commercial and public building requirements.

CLARAGE

The Sign of Resourceful Engineering and Economical Performance



INDUSTRIAL FANS—for blowing or exhausting. Large range of capacity sizes—suitable for many applications.



MECHANICAL DRAFT FANS—both forced and induced draft. Heavy-duty construction for continuous operation at peak loads.

CAST IRON FANS—for industrial services. Unique construction assures extra long life when handling corrosive gases.

What you're looking for in air handling and air conditioning you are likely to find at Clarage Fan . . . highly efficient, dependable equipment — job engineered to your particular needs . . .

It's nearly 40 years since we started building fans, blowers and allied products. We have had ample time to temper research with experience, engineering with sound practice, manufacturing to actual operating in-the-field demands . . . .

You can profit by dealing with Clarage. We have an established reputation for getting things done right . . . . As evidence of what we mean, 97 of the 100 largest American corporations are users of Clarage fan equipment. Need we say more?

CLARAGE FAN COMPANY

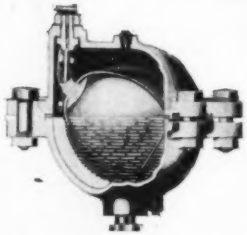
615 PORTER ST., KALAMAZOO, MICH.

SALES ENGINEERING OFFICES IN ALL PRINCIPAL CITIES

IN CANADA: 4285 Richelieu St., Montreal
Canada Fans, Ltd.

You Can Rely on Clarage

GET RID OF AIR ACCUMULATIONS IN PIPE LINES...



a BIG Trouble Saver that Costs You LITTLE!

When air lodges at high spots in pipe lines, it reduces the effective area of the pipe, creates a friction head, lowers pumping capacity, and may result in serious water hammer!

Simplex Air Release Valves bring you a sure, efficient cure for these difficulties . . . venting air *automatically before it can cause damage.*

The Simplex Air Valve is easily installed . . . positive in action . . . ample in capacity. Standard valves for pressures up to 250 p.s.i. . . . special valves for pressures up to 800 p.s.i. Thousands have been in successful use for over 30 years.

IT'S SIMPLEX IT'S ACCURATE

Write for free bulletin to Simplex Valve & Meter Co., Dept. 5, 6780 Upland Street, Philadelphia 42, Pa.

SIMPLEX
VALVE AND METER COMPANY

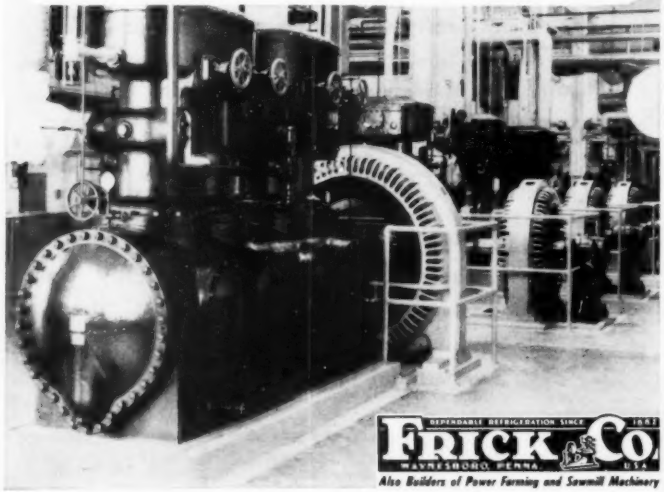
FRICK Refrigeration Serves Lucky Lager Brewing Co.

This Brewery in Los Angeles County, California, one of the finest in the country and one of three Lucky Lager Breweries on the Pacific Coast, uses four large Frick ammonia compressors with unusual reliability and economy in producing 700,000 barrels of beer annually.

Installation by Eckert Engineering Co., Frick Distributors at San Francisco.

For the answer to your air conditioning, quick-freezing, ice-making or refrigeration problems, look to

FRICK COMPANY • Waynesboro, Penna.

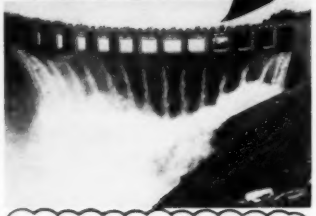


DEPENDABLE REFRIGERATION SINCE 1882
FRICK CO.
WAYNESBORO, PENNA. U.S.A.

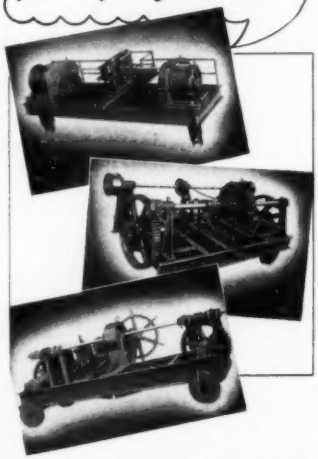
Also Builders of Power Farming and Sawmill Machinery

MURCO *Murray*

GATES and GATE HOISTS



DESIGNED and BUILT TO MEET ALL REQUIREMENTS *for any Size Dam...*



Murray Gate Hoists are designed and built in a wide range of capacities from less than one ton to over one hundred tons . . . from the smallest hand operated to the largest motor operated gate hoist.

During our over half century of designing and building gate hoists, we have developed many designs for the different types of gate hoist problems. Perhaps we have several designs and patterns that will fit your requirements. In planning gates or gates hoists, we suggest you communicate with us before your plans for the project as a whole, are complete . . . it will save expense and much preparation time. We also build gate hoists especially from your plans and specifications, if desired.

Write for complete information and Engineering Department recommendations.

D. J. MURRAY MANUFACTURING CO.
WAUSAU, WIS.
Manufacturers Since 1883

BITUMINOUS

Power source that needs no pampering

One of the outstanding advantages of Bituminous is its *storability*. This dynamic, low-cost fuel can be stockpiled anywhere—in any volume. Construction of storage facilities is not required when fuel needs increase.

Add to this the *excellence* of Bituminous mined along the Baltimore & Ohio, the wide *variety* available, and its *accessibility* through convenient transportation to industrial centers—and you have ample reason for choosing B&O coals. For helpful advice, *ask our man!*

BITUMINOUS COALS FOR EVERY PURPOSE

BALTIMORE & OHIO RAILROAD

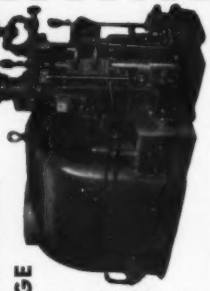
Constantly *doing things*—better!

MURRAY

Builders of Steam Power Equipment for over 75 years

STEAM TURBINES

TYPE UV MULTISTAGE



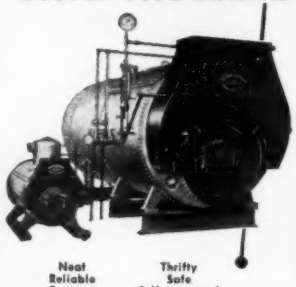
• Available with from two to ten pressure stages. Horsepower range from 100 to 4000, steam pressures up to 600# ga., 750°F., condensing or non-condensing. Optional governor equipment and accessories adapt UV Turbines to any mechanical drive within their capacity range.

Contact your Murray representative or write for Bulletin T-122.

MURRAY IRON WORKS COMPANY, BURLINGTON, IOWA

LEFFEL

SCOTCH TYPE BOILERS



Neat Reliable Compact

Thrifty Safe Self-contained

Leffel offers you the exact boiler to suit your plant need. Available in conservative ratings of 6 through 250 *actual* horsepower, Leffel boilers are built to take substantial overloads. And the savings on fuel will amaze you. Where boiler room space is at a premium, a compact Leffel is the answer. COAL, GAS or OIL fired; easy to convert from one type of fuel to another. (For stoker firing, the specially designed Leffel Underfeed Stoker may be used). Before you buy a boiler, it will pay you to get the facts on the line of Leffel Scotch Type Boilers.

Write for descriptive catalog.

The James Leffel & Co.

Dept. O — Springfield, Ohio

Refinite

serves the World

WITH WATER CONDITIONING EQUIPMENT & SERVICE

Refinite OMAHA, NEB.

WATER REFINING EQUIPMENT

WRITE FOR FREE BULLETINS ON HOW REFINITE CAN SERVE YOU. ADDRESS: DEPARTMENT P-A

ALLPAX GASKET CUTTERS

A FRIEND INDEED WHEN IN NEED

Engineers everywhere are "sold" on ALLPAX Gasket Cutters to take care of emergency needs as well as maintenance requirements and new work. These convenient, practical tools cut all gasket materials accurately and quickly. They are time and material savers in any plant. No plant can afford *not* to have an ALLPAX Gasket Cutter handy, ready for use at any time.

With this tool, gaskets from ¼" to 48" diameter can be cut from asbestos sheet, rubber, duck, canvas, felt, cardboard, etc. The NEW, Improved ALLPAX cutter sells for $26.00 and is furnished complete in durable metal case, ready to go to work for you.

ALLPAX also makes a "Junior" cutter for cutting ¼" to 6" gaskets in round, oval, square or irregular shapes. This low cost cutter sells for $7.50 fob factory.

Either of these Gasket Cutters will pay for itself on the first job. Order today.

ALSO: Packings for all services; Packings to order for Special Services; Valve Discs; Retainer Packing; Molded and Mandrel Cut Packing Rings; Packing Hooks.

Ask for a Copy of: *the complete ALLPAX catalog. Get in touch with your nearest distributor for your requirements . . . or write us direct.*

THE ALLPAX COMPANY INC.

805 Mamaroneck Ave., Mamaroneck, N.Y.

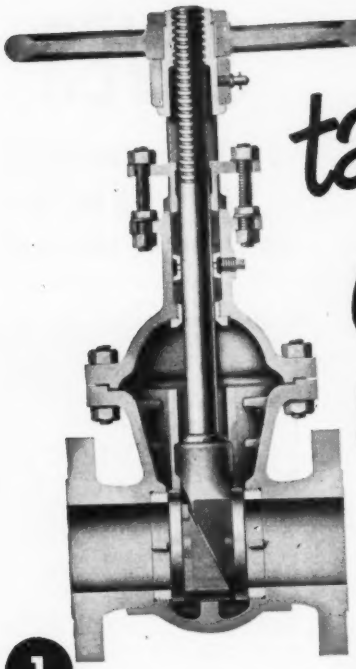
Superheat Sheet Packing . . . Oil Proof Sheet Packing
. . . Red Rubber Sheet Packing . . . Diaphragm Sheet Packing . . . Cloth Inserted Sheet Packing

PLUS VALUES, JOB-PROVED AGAIN AND AGAIN

DARLING VALVES

take your choice...

FOR BETTER, LOWER COST SERVICE WITH DARLING cast steel gate valves



1

2

DARLING VALVES FOR EVERY NEED

Darling gate valves are made in a wide range of sizes, types and constructions for all kinds of normal and unusual service . . . and for pressures up to 1500 pounds.

IN addition to gate valves of solid wedge design, Darling offers two other types. Both have distinctive features that prolong valve life while minimizing down time and maintenance. They're great time and money savers! . . .

1 This view shows a Darling gate valve of the fully revolving, double disc, parallel seat type. Time and again users rate it the most trouble-free, best performing gate valve obtainable today. Why? Because its unique design assures: *automatic* adjustment for valve body distortion . . . positive, easy operation . . . uniform wear distribution . . . foolproof simplicity in maintenance and reassembly . . . and service life seldom if ever equalled.

2 Take a close look at the slotted, double-grooved wedge in this cutaway view. There's little wear and tear on *these* wedge faces and seats because the slot permits compression of the wedge to compensate for valve body expansion or contraction due to temperature changes. Moreover, the double grooves, with twin guide ribs in the valve body, provide twice the usual bearing area, eliminating wedge canting and avoiding damage to the downstream seat.

SEND FOR BULLETIN

Why not get *all* the facts on these money-saving valves? Then *you* can analyze and decide whether or not you stand to gain by giving Darlings a try. Simply specify your service requirements . . . or ask for cast steel valve bulletin.

DARLING VALVE & MANUFACTURING CO.

Williamsport 8, Pa.

Manufactured in Canada by Sandilands Valve Manufacturing Co., Ltd., Galt 19, Ont.

Sensitive

PRESSURE CONTROL

for Steam, Air, or Gas

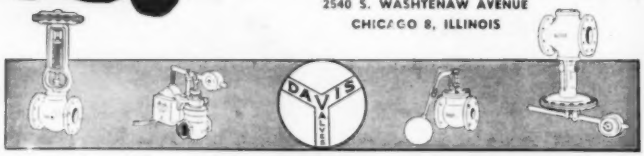
Here is the Davis diaphragm motor valve with pressure controller that gives you accurate control for pressure reducing, pressure relief or back pressure service on steam, air, or gas!

- **Panel or valve mounted controller. Quick, easy, adjustment for change of pressures.**
- **Spring loaded, balanced type innervalve. Direct or reverse acting.**
- **Bronze, semi-steel, or steel body. Special trim for corrosive services.**
- **Sizes ½ to 14". For indoor or outdoor installation.**
- **Initial pressures to 1500 p.s.i. Reduced pressures from 1000 p.s.i. to 1 p.s.i.**

Investigate the Davis No. 401 Regulator. When inquiring state service, size, pressure and temperature conditions. Ask for complete information.

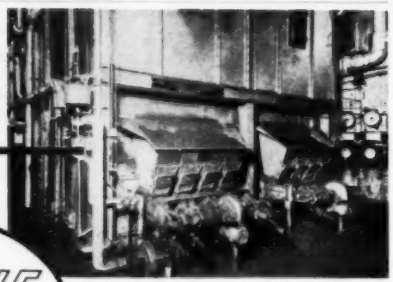
DAVIS REGULATOR CO.

2540 S. WASHTENAW AVENUE
CHICAGO 8, ILLINOIS



"Working their way"

...IN COLLEGE!



TITUSVILLE
IRON WORKS CO
TITUSVILLE, PA.

3-DRUM WATER TUBE BOILERS

Like many another Titusville school installation throughout America, these two A-3-15 3-Drum Water Tube Boilers are the heart of reliability for Catholic University, Washington, D. C. ● Steel cased. Stoker fired. Battery setting. ● *Let us have your inquiries!*

THE TITUSVILLE IRON WORKS COMPANY

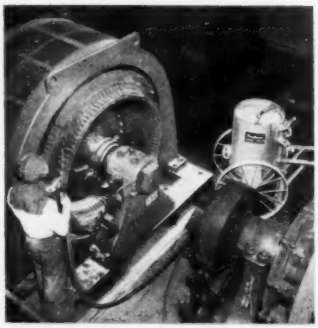
a division of **Struthers Wells** **TITUSVILLE, PENNA.**

Representatives in Principal Cities

Pangborn SAVES

90.9% on materials
66.7% on labor
in cleaning motors!

. . . reports user of Pangborn Corn Cob Blast Machine



Cleaning Duplicate 500 hp Synchroneus Motors		
	Material	Labor
Solvent Method	$55.00	120 hrs.
PANGBORN Method	5.00	40 hrs.
SAVING	50.00 (90.9%)	80 hrs. (66.7%)
Remarks: With Solvent, drying period took an additional 8 hours.		

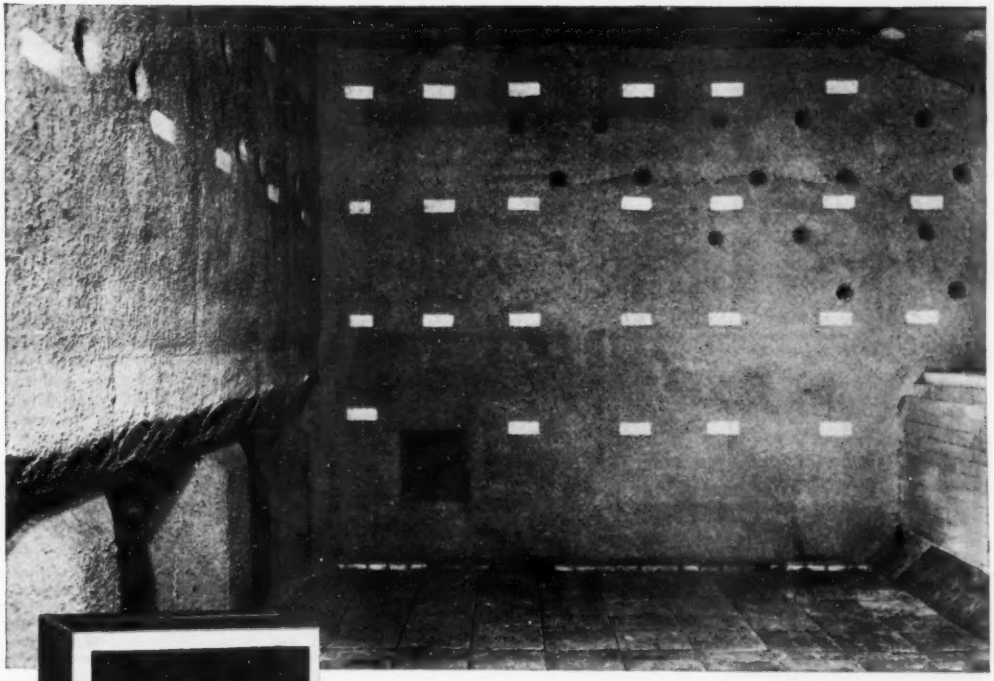
ACTUAL cost-time records prove that the portable Pangborn AC-4 "Corn Cob" Blast Machine scours armatures, parts, frames, coils, etc., in ⅓ the time of other methods. In addition, materials and labor costs are drastically cut, toxic dangers are eliminated, and there's no waiting for parts to dry.

Soft, 20-mesh corncob grits do the job with 40-lb. air pressure, whisking away grease, oil, paint flakes, etc. FOR FULL INFORMATION on how the Pangborn AC-4 can help you, write us and tell us what you clean. Address: PANGBORN CORP., 90 Pangborn Blvd., Hagerstown, Maryland.

Look to Pangborn for the latest developments in Blast Cleaning and Dust Control equipment

Pangborn

BLAST CLEANS CHEAPER with the right equipment for every job



A. P. Green SUPER-PLASTIC refractory lining in large coal drier furnace. SUPER-PLASTIC is a super duty plastic firebrick for use in zones where conditions are most severe. A. P. Green monolithic linings of this type are joint-free, highly resistant to spalling and slag attack, and provide an airtight, securely anchored unit that gives greatly increased service life.

A. P. GREEN

MONOLITHIC REFRACTORY LININGS

Last Longer, Save You Money

More and more boilers and industrial furnaces are being lined with A.P. Green engineered monolithic refractory linings, because furnace operators recognize the savings available in terms of longer life and lower maintenance costs.

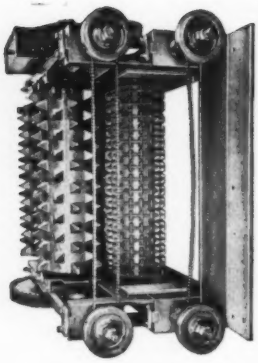
Monolithic construction, utilizing A. P. Green castable and plastic refractories, results in a lining which reduces "down time," cuts maintenance costs, and lasts longer. It is a combination of the highest quality materials and sound refractory engineering.

For properly engineered one-piece monolithic furnace linings which are airtight, with no exposed joints open to attack by flame or slag. . . linings that are quickly and easily installed . . . do not bulge . . . and give longer life—call your local A. P. Green distributor. He is listed in the yellow pages of your telephone directory.

Distributors in the Principal Cities of the World

A. P. Green REFRACTORY PRODUCTS

A. P. GREEN FIRE BRICK CO.
Mexico, Missouri, U. S. A.
In Canada:
A. P. GREEN FIRE BRICK COMPANY, LTD.
Toronto 15, Ontario



Crusher is pictured without hopper and sprocket guards, but is delivered complete.

TWO STAGE — DOUBLE ADJUSTMENT

WRITE TODAY FOR CRUSHER BULLETIN P-3

Two Stage CRUSHING IN ONE MACHINE!

Fulfilling an urgent need in the industry, the GUNDLACH "Two Stage" Crusher has delivered over 852 usable stoker coal from an Illinois mine run lot.

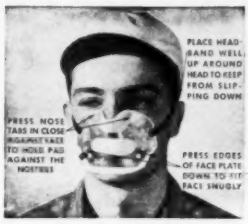
The GUNDLACH "Two Stage" Coal Crusher incorporates two crushing stages in one machine and is designed to reduce RUN-OF-MINE to STOKER COAL in ONE operation. Compact design simplifies structural supports and installation. Rugged simple construction combined with engineering proved in the field makes this machine a profitable and reliable unit.

MATERIAL SIZE CAN BE CHANGED WHILE MACHINE IS RUNNING

All Gundlach Crushers are equipped with Gundlach Patented Crushing rollers. (Pat. No. 2578340)

T. J. GUNDLACH Machine Co., Belleville, Ill.

MARTINDALE PROTECTIVE MASKS


PLACE HEADBAND WELL UP AROUND HEAD TO KEEP FROM SLIPPING DOWN
PRESS NOSE TABS IN CLOSE AGAINST FACE TO HOLD PAD AGAINST THE NOSTRILS
PRESS EDGES OF FACE PLATE DOWN TO FIT FACE SNUGLY

Weigh Less than ½ ounce.

Clean, cool, comfortable. Furnish excellent protection against non-toxic dusts except free silica. Replaceable cotton pads are inexpensive and sanitary.

Martindale Protective Masks	$.30 ea.
No. 1 Refills (Standard weight)	.02 ea.
No. 2 Refills (heavyweight)	.02½ ea.

Masks packed in individual envelopes. Refills packed in envelopes containing 25. No. 2 (heavyweight) Refills contain twice as much filtering cotton as No. 1.

DISCOUNTS

Less than $10.00 list	Net
$10.00 to $24.99 list	10%
$25.00 to $99.99 list	15%
$100.00 and over	20%
Minimum, charge account or C.O.D.	$2.00
Minimum, cash with order	$1.00

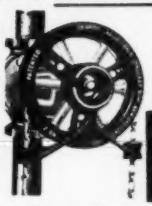
If payment accompanies order we will pay parcel post or express charges.

MARTINDALE ELECTRIC CO.
1367 Hird Ave. Cleveland 7, Ohio

NOW! All Overhead Valves are Instantly Accessible

with the LOW-COST

Babbitt —Adjustable— SPROCKET RIM with Chain Guide



• Range of 10 adjustable sizes takes care of all valve makes and types; fits valve wheel diameters from 2 to 30 inches.

• Overhead valves — no matter how high up, or in whatever hard-to-get-at location — are instantly accessible from the floor! Operation of valves is quick, easy, positive and safe with the BABBITT Adjustable Sprocket Rim with Chain Guide. No more climbing on bench, machine, boiler or treacherous stepladder; no time-wasting.

• The BABBITT Adjustable Rim fits all valves, with either rising or non-rising stems. It is installed quickly by clamping onto the hand wheel of the valve.

• Write today for Catalog Bulletin P, surprisingly low prices, and name of nearest distributor.

BABBITT STEAM SPECIALTY CO.
1 Babbitt Square, New Bedford, Mass.

WON'T STICK
WON'T JAM
WON'T FREEZE

MANY SMALL DISCS INSTEAD OF ONE LARGE DISC REDUCES IMPACT, MAKES A TIGHTER VALVE.

MANY SMALL PORTS INSTEAD OF ONE LARGE PORT PREVENTS FAILURE, MULTIPLIES FLOW AREA.

COCHRANE MULTIPORT RELIEF VALVES

COCHRANE CORPORATION • • PHILADELPHIA 32, PA.

proof of why it pays
to specify
BROWN BOVERI
AIR BLAST BREAKERS

Q.E.D.

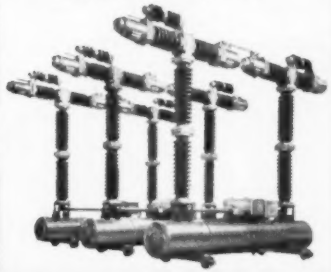
Quality 17 years of progressive engineering and skilled craftmanship are responsible for Brown Boveri's world leadership in Air Blast Breakers. High Speed—High Current Carrying Capacity—Positive interruption under all conditions—Rapid Reclosing—make these breakers outstanding for their dependable performance.

Economy * Low initial cost—Minimum maintenance. No oil—No fire—No mess.

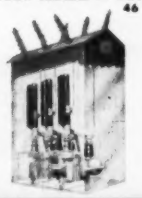
Delivery Faster than you would expect under today's unusual conditions.

* One of America's leading utilities had this to say about Brown Boveri Breakers . . . "It is also worthy to mention that the simplicity of assembly, ease of erection and minimum of adjustment necessary after assembly, is an outstanding feature of their breakers."

OUTDOOR BREAKERS — 69 TO 230 kV



OUTDOOR CUBICLES — 14.4 TO 46 kV



Q.E.D. — Brown Boveri Air Blast Breakers are available from 230 kV down to 7.5 kV covering the full range of A.S.A. Standards.

write for data!

BROWN BOVERI CORP., 19 Rector Street, N. Y. 6
Please send me specifications and details on your
☐ indoor ☐ outdoor air blast breakers for
kV____ Amps.____ kVA.

Name _____ Title _____

Company _____

Address _____

BROWN BOVERI

BROWN BOVERI CORPORATION
19 RECTOR STREET, NEW YORK 6, N. Y.

—it **pays** to be accurate!

WHETHER slicing apples, or slicing fuel costs in the boiler room, lack of accuracy means a loss. If the combustion control system in your boiler room is not precisely accurate, you lose—and the loss that goes up in smoke can be more than you'd think.

Look at it this way. A medium sized boiler could use $10,000,000 worth of fuel in its normal operating life.

Now—if your combustion control system is not *dependably* accurate, that system would ultimately cost you five, six, or seven times its initial cost!

From this point of view, you cannot afford to buy anything less than the best—anything less than a Hagan Combustion Control System.

Our engineers will be glad to discuss what the Hagan Combustion Control System can do for you.

For more information, write, wire or phone:

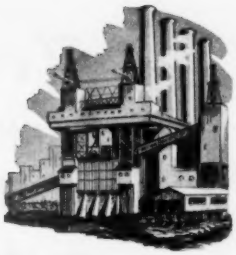
HAGAN
HALL
BUROMIN
CALGON

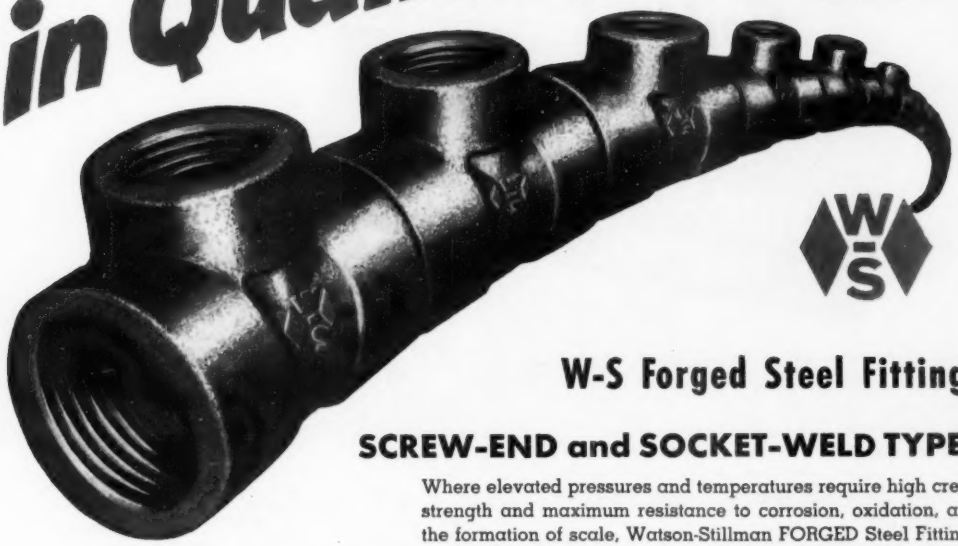
HAGAN CORPORATION

HAGAN BUILDING, PITTSBURGH 30, PA.

BOILER COMBUSTION CONTROL SYSTEMS
RING BALANCE FLOW AND PRESSURE INSTRUMENTS
METALLURGICAL FURNACE CONTROL SYSTEMS
THRUSTORQ FORCE MEASURING DEVICES

Quality... in Quantity





W-S Forged Steel Fittings

SCREW-END and SOCKET-WELD TYPES

Where elevated pressures and temperatures require high creep strength and maximum resistance to corrosion, oxidation, and the formation of scale, Watson-Stillman FORGED Steel Fittings deliver the *strength* for *Power* . . . keep equipment on the line to greater operating economy and higher profits.

Quality—in Quantity—has earned and sustained the Watson-Stillman position of first-to-see when industry seeks a solution to a specific fittings problem. Despite an enormous increase in the use of its low *service* cost fittings, Watson-Stillman has never relaxed its concern for the metallurgical aspects of product development.

First to identify itself with the establishment of standards for the properties of special purpose fittings alloys, Watson-Stillman technicians continue in close association with the engineering research efforts of a score of basic industries . . . will be glad to lend a hand on *your* next fittings problem.

9-M-3

• **Stronger** • **Smaller** • **Lighter** • **Tighter**
• **More Uniform** • **Lower *Service* Cost**

SOLD THROUGH LEADING DISTRIBUTORS . . . EVERYWHERE

DISTRIBUTOR PRODUCTS DIVISION

ROSELLE, NEW JERSEY

WATSON-STILLMAN
ESTABLISHED 1848

Designers and Manufacturers of Forged Steel Fittings, Wire Rope Shears, Hand Pumps, Jacks, Pipe Benders and Hydraulic Equipment

Today's GENERAL HIGH COST TREND SUGGESTS ATTENTION TO YOUR Boiler Room

GET IMMEDIATE AND PERMANENT RESULTS WITH

CASH STANDARD AUTOMATIC COMBUSTION CONTROL SYSTEMS

AS A SOURCE OF IMPORTANT SAVINGS

Today cost pressure keeps demanding new ways to save money. You can get at the root of this situation in your boiler room.

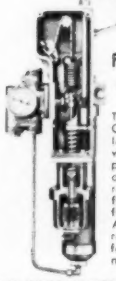
Whether you have one or a battery of boilers you'll find your boiler room can deliver good savings through Correct Fuel Feed — Fuel-Air Ratio, and Over-Fire Draft.

You accomplish this with CASH STANDARD Automatic Combustion Control Systems. What you actually get is more steam from your present boiler—less fuel, coal-oil-gas used—savings in maintenance. CASH STANDARD units are available in a number of variations. Combinations can be made to give you complete automatic control with all of its benefits. Size of your boiler or type make no difference.

Send for

BULLETIN 300

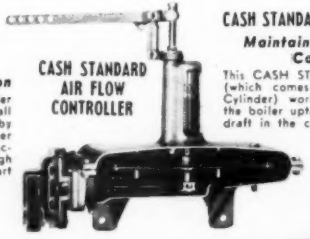
It shows applications—tells how the system works—gives you a good insight into the savings possible.



CASH STANDARD FUEL FEED CONTROLLER . . .

Automatically Regulates Fuel Feed

This CASH STANDARD Master Controller automatically regulates fuel feed. Locate it conveniently. Working from boiler pressure, it will adjust the rate of combustion by regulating the rate at which fuel (any kind of fuel) is supplied to the boiler furnace. And it will adjust the Air Flow Controller so the correct amount of air is supplied for proper combustion — hence, money saving.



CASH STANDARD AIR FLOW CONTROLLER

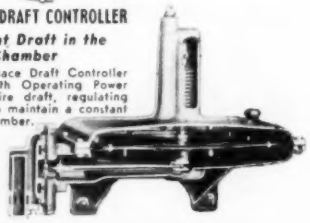
Meters the Air Needed for Combustion

This CASH STANDARD Air Flow Controller meters the air needed for combustion. Install it near its damper. It is not affected by changes in fuel bed resistance or any other variables, because it meters air supply according to the differential pressure through the gas passages of the boiler, doing its part to insure perfect combustion.

CASH STANDARD FURNACE DRAFT CONTROLLER

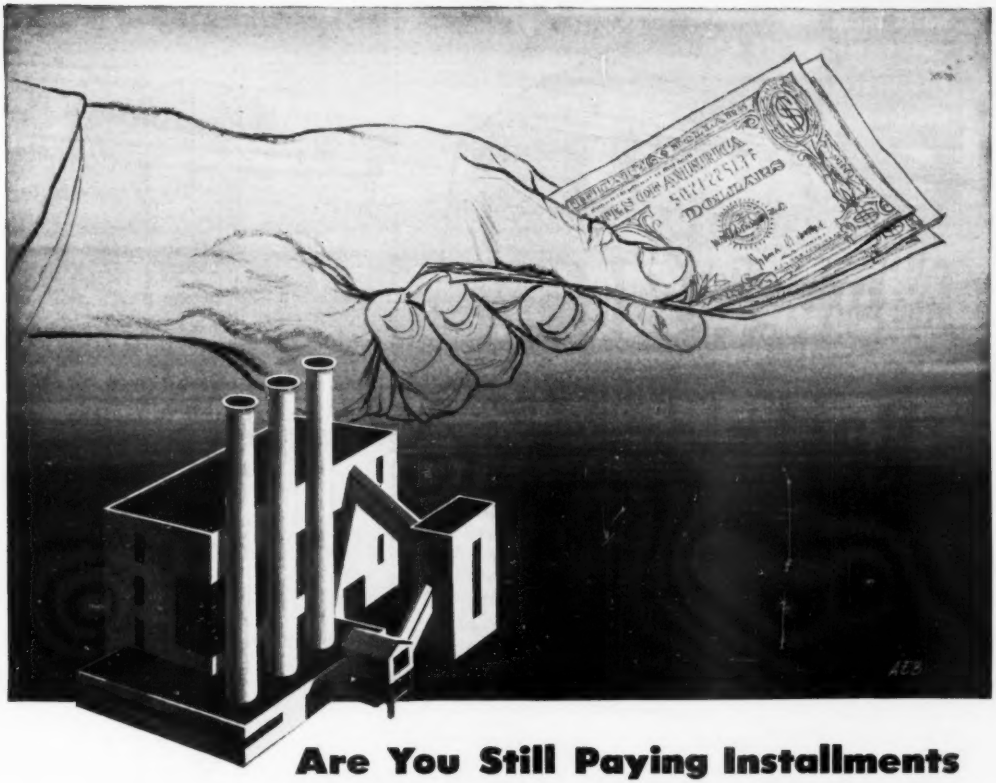
Maintains a Constant Draft in the Combustion Chamber

This CASH STANDARD Furnace Draft Controller (which comes complete with Operating Power Cylinder) works from overfire draft, regulating the boiler uptake damper to maintain a constant draft in the combustion chamber.



A. W. CASH COMPANY
DECATUR, ILLINOIS

CASH STANDARD CONTROLS . . VALVES



Are You Still Paying Installments On Equipment You Already Own?

When you've got the receipt, equipment's supposed to be yours. Yet many operators go right on paying "installments" . . . in heavy maintenance, high operating costs, production lags.

This sounds like the granddaddy of all blind alleys. Yet consider what *one* power station did:

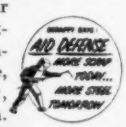
Faced with "rat-holing" and high maintenance costs, this company solved *its* problem with a 1400-ton bunker, using monel-clad steel for the bottom six feet of the four bunker noses. This solved corrosion and abrasion threats, assured surface smoothness, ended packing of moist fines that lead to "arching" and "rat-holing".

RESULTS: steady feed, without vibrators or a stand-by man . . . smoother flow to direct-firing pulverizers . . . lower operating costs.

What makes this story significant is that it resulted from a progressive planning method followed by certain Equipment Builders.

This method coordinates the knowledge of leading engineers, designers, and materials suppliers. Each factor affecting performance is *thought out by a specialist in that field.* In such planning, you'll find these builders turning to Lukens for its knowledge of materials, as well as its wide range of low cost clad steels.

Even with new equipment hard to get, we know builders who often can help you get more profitable performance from what you have. For their names, write us today, explaining your need. Manager, Marketing Service, 585 Lukens Building, Coatesville, Pennsylvania.



LUKENS

LUKENS STEEL COMPANY

WORLD'S LEADING PRODUCER OF SPECIALTY STEEL PLATE • PLATE SHAPES • HEADS • CLAD STEELS

NOTES FROM THE PUMP ENGINEER'S HANDBOOK

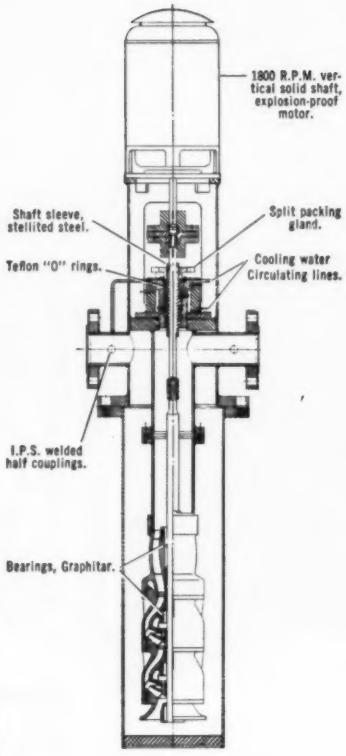
Little Details Like the XXX Seal Make Johnston Pumps Better!

Johnston pump bowl assemblies fitted with enclosed impellers have the Johnston XXX Seal—just another small detail that makes each Johnston the pump with real inside qualities. The design of the Johnston Seal, formed by the impeller shroud and the wear ring, provides sealing surfaces which prevent *any loss of efficiency* caused by liquid by-passing.

The extra hardness of the renewable aluminum bronze wear ring over standard bronze construction gives added protection, longer life and higher *sustained* pump efficiency. This is just one of the many little inside quality features that make each Johnston Pump better.

Every Johnston Pump is engineered for the specific duty for which it is intended. Trained hydraulic engineers are available at your nearest Johnston Dealer or at the Johnston factory to furnish detailed information, proposals and anything else necessary to meet your particular pumping equipment needs. Compare the inside qualities of Johnston Pumps and you'll never buy any other!!!

Sizes from 4 to 32 inches; single- or multi-stage; 2 to 1000 H.P.; capacities to 10,000 G.P.M.; lifts to 1000 feet; for liquid temperatures to 400° F.



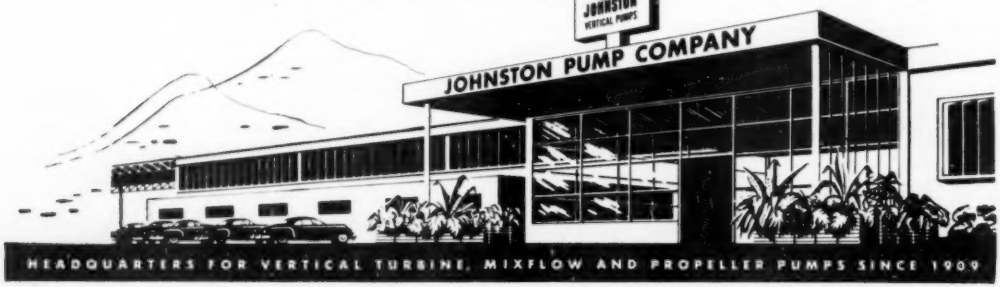
SPECIAL DUTY PUMP FOR CONDENSATE RETURN

Due to the extremely high temperatures and pressures, the packing box has always been the vital point of a pump in condensate service. The gland on this unit was designed for 366° F. against a boiler pressure of 125 p.s.i. and is typical of the specialized equipment designed and furnished by Johnston engineers. A study of the customer's requirements indicated a NPSH of 3 feet. Actually this vertical pump unit required only a NPSH of zero at centerline of suction.

JOHNSTON PUMP COMPANY

3272 EAST FOOTHILL BLVD., PASADENA 8, CALIFORNIA

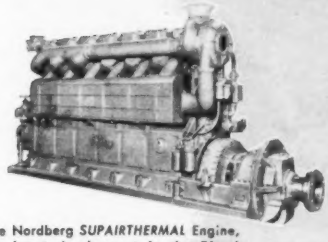
JOHNSTON VERTICAL PUMPS



HEADQUARTERS FOR VERTICAL TURBINE, MIXFLOW AND PROPELLER PUMPS SINCE 1909

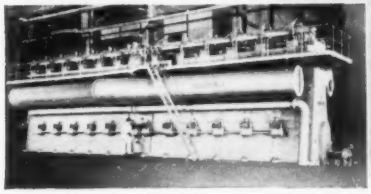
FOR THE BEST SOLUTION TO YOUR POWER PROBLEMS...

LOOK TO NORDBERG

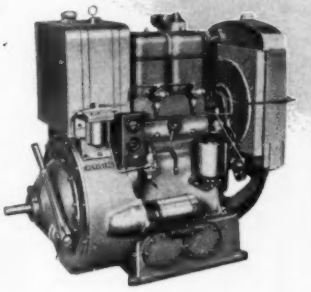


The Nordberg *SUPAIRTHERMAL* Engine, the latest development in the Diesel field, is available in a complete range of 4-cycle types for all applications, in sizes from 425 to 3200 H.P.—including Diesel, Duafuel, or spark fired gas operation.

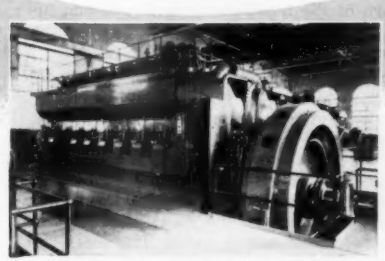
—builders of America's largest line of HEAVY DUTY DIESEL ENGINES— 10 TO 10,000 HORSEPOWER



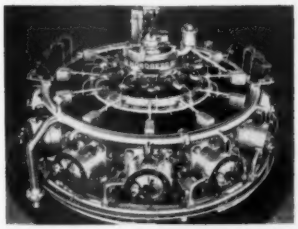
Nordberg 2-cycle Diesels for marine or stationary service are built in a wide range of types and sizes, from 880 to 10,000 H.P.



Nordberg "Packaged" Diesel Power Units—from 10 to 45 H.P., 9 to 30 K.W., for generating electricity, pumping, and straight power applications.



Nordberg 2-cycle Duafuel engines are built in a wide range of sizes from 880 H.P. upward—all of which burn oil, gas, or any combination of both — and are instantaneously convertible from one fuel to another, under full load.



Nordberg 2-cycle Radial engines develop 2125 H.P. or 1500 K.W. at 400 R.P.M. Available as an oil burning Diesel, as a natural gas engine, and as a Duafuel engine.

IN the complete line of Nordberg two and four-cycle oil burning and Duafuel Diesels and gas burning engines, you will find the right size and type of unit to meet your power requirements.

From the smallest to the largest engine, every Nordberg unit is built to deliver low-cost, dependable power . . . and the basic dependability of Nordberg engines has been amply proved in service on hundreds of successful stationary and marine power applications all over the world.

If you're planning on adding to your present power capacity, or providing new power facilities, it will pay you to investigate the long life and dependable service you get with Nordberg Engines. Write for further details, outlining your power requirements.

NORDBERG MFG. CO., Milwaukee, Wisconsin

P-SHM152

BUSCH-SULZER
A DIVISION OF NORDBERG

NORDBERG
DIESEL ENGINES

GET

"PIN POINT CONTROL"

WITH

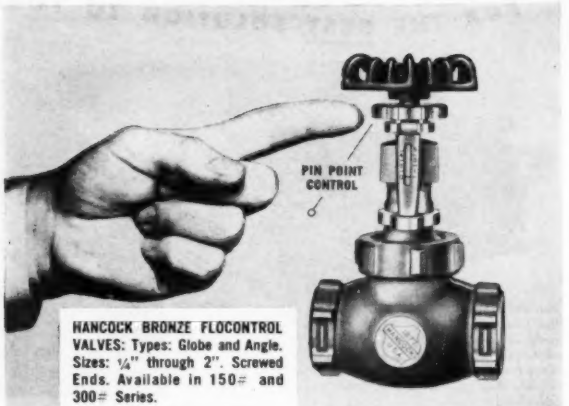
HANCOCK

FLOCONTROL VALVES

Say "good-bye forever" to filed notches, paint daubs, string tying and other makeshift ways of marking globe valve settings. With Hancock Flocontrol Valves in your lines, you can be sure of "pin point control" of flow, temperature or pressure. The sturdy micrometer dial and pointer attached to the bonnet permits settings to within a 1/100th turn of the handwheel! And, you can instantly duplicate any setting exactly, any time.

Hancock Flocontrol Valves are available in bronze and steel. Both types are strong, leak-defying valves with scientifically designed V-Port disc that *compels proportional flow throughout the entire lift of the valve stem.* Because these valves have long-wearing Acme threads, straight-line flow is not dependent on the short-wearing, fine threads of a needle valve. The seats and discs are superfinished "500 Brinell" stainless steel. Foreign substances or steam cutting effects are minimized.

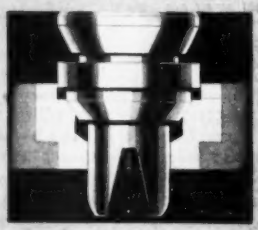
Eliminate guesswork. Minimize repairs and maintenance. Install the most efficient and economical valves you can use — Hancock Flocontrol Valves. Get in touch with your nearby Hancock Distributor for complete information.



HANCOCK BRONZE FLOCONTROL VALVES: Types: Globe and Angle. Sizes: ¼" through 2". Screwed Ends. Available in 150# and 300# Series.

HANCOCK 600# STEEL FLOCONTROL WELDVALVES: Types: Globe and Angle. Outside Screw and Yoke. Sizes: ¼" through 4" Screwed, Socket Welding and Flanged Ends. Available with 150#, 300# and 600# Series Flanges.

V-PORT DISC is scientifically designed. Shut-off seating surface is entirely removed and separate from the controlling V-Ports. Wire-drawing and cutting action are minimized. No separate shut-off valve needed. Hancock Flocontrol Valves are "2 in 1" valves. The separate seating surface on the V-Port disc gives you a shut-off valve as well as a control valve.



When Hancocks go in, valve costs go down

HANCOCK VALVES

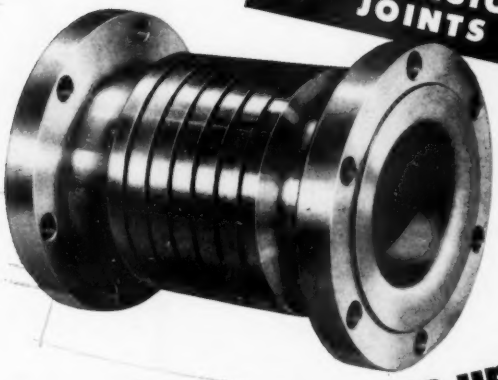
A product of MANNING, MAXWELL & MOORE, INC. WATERTOWN 72, MASSACHUSETTS

MAKERS OF 'HANCOCK' VALVES, 'ASHCROFT' GAUGES, 'CONSOLIDATED' SAFETY AND RELIEF VALVES, 'AMERICAN' INDUSTRIAL INSTRUMENTS. BUILDERS OF "SHAW-BOX" CRANES, 'BUDGIT' AND 'LOAD LIFTER' HOISTS AND OTHER LIFTING SPECIALTIES.

FLEXONIFLEX

High Pressure

EXPANSION JOINTS



Flexonics engineered for pressures up to

5500 psi!

The Flexonics Expansion Joint Design Guide offers helpful data on the selection and application of expansion joints for all services. Write for your copy, today.

With its Flexoniflex line of expansion joints, Flexonics Corporation offers the first practical, in-line expansion joint for high pressure piping systems. Depending upon size and temperature, Flexoniflex units will handle pressures from vacuum to 5500 psi. Temperatures from –400° F. to 1600° F. can be accommodated at reduced pressure at the temperature extremes. Sizes range from ½" pipe through 6" pipe. Consult Flexonics Corporation's Engineering Department for information on larger sized units.

In construction, Flexoniflex units consist of one or more plies of corrugated stainless steel with integral control rings. They are available with either flanged or welding ends.

If you have high pressure piping we would like to show you how Flexoniflex Expansion Joints can solve your expansion control problems.

Flexonics *Corporation*

FLEXON BELLOWS DIVISION
1301 S. THIRD AVENUE · MAYWOOD, ILLINOIS

FORMERLY CHICAGO METAL HOSE CORPORATION

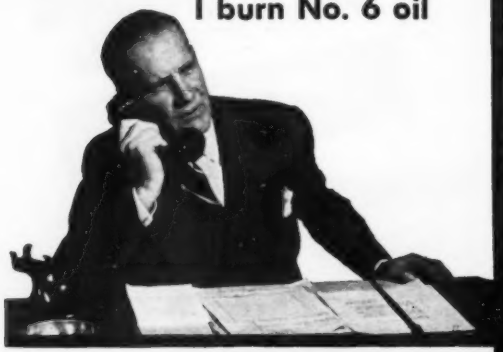
Flexon identifies products of Flexonics Corporation that have served industry for over 50 years.

Manufacturers of Convoluted and Corrugated Flexible Metal Hose in a Variety of Metals · Expansion Joints for Piping Systems · Stainless Steel and Brass Bellows · Flexible Metal Conduit and Armor · Assemblies of These Components

In Canada: Flexonics Corporation of Canada, Ltd., Brampton, Ontario

1.

That's right!
I burn No. 6 oil

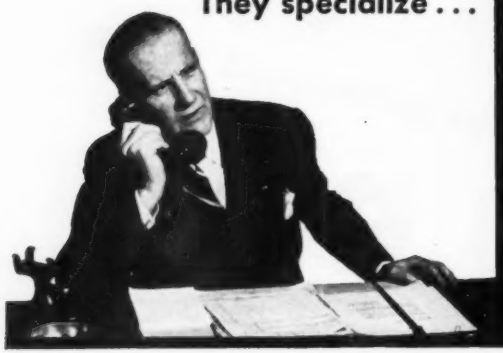


2.

No, not a bit of trouble!

3.

Yes, it's a Preferred.
They specialize . . .



4.

. . . in fully*automatic operation with residual fuels!

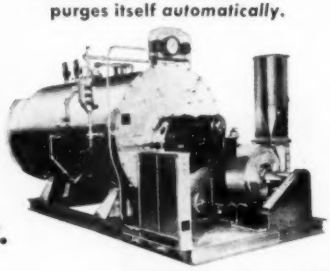
That plant engineer is only one of hundreds who label us specialists in *fully* automatic operation with residual oils. We're proud of the title, of course, for we achieved what many folks said couldn't be done. But, actually, we at Preferred like to be thought of as all-around experts in combustion problems. Witness the complete Preferred line of gas, combination oil-and-gas and light oil-fired steam generators.

We tackled and solved the problem of residual oils, because we knew we could cut your production costs by $3,000 to $35,000 a year by reducing fuel costs. Scores of Preferred customers have already pocketed these savings. Like the engineer on the 'phone, they are burning No. 6 oil with *fully* *automatic operation.

If you are now using more expensive grades of fuel, discuss your installation with a Preferred representative or write for Bulletin 175 about the Preferred Horizontal Rotary Oil Burner and Bulletin 1000 which describes the Preferred Unit Steam Generator.

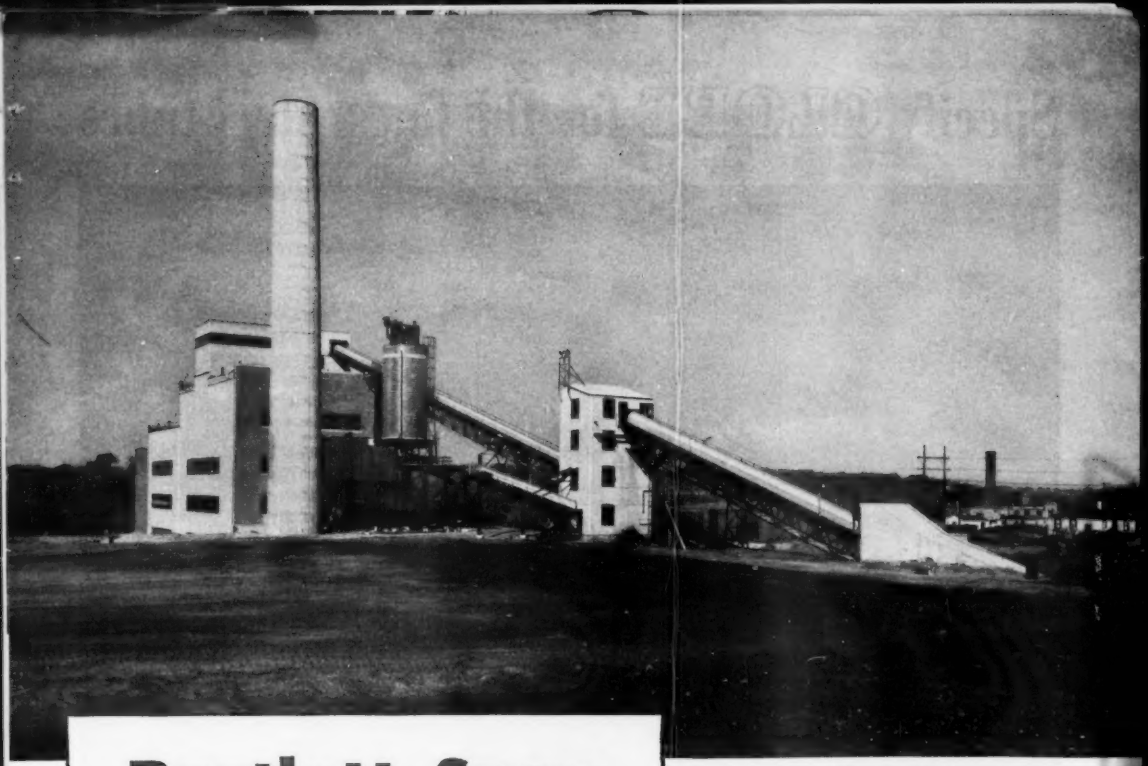
*What We Mean By *Fully Automatic* Operation

- Starts *automatically*
- Ignites *automatically*
- Starts at low fire and follows load *automatically*
- Shuts off, cleans and purges itself *automatically*.



PREFERRED UTILITIES MANUFACTURING CORP.
1860 BROADWAY, NEW YORK 23, N. Y.

PR 205



Bartlett-Snow coal handling at Rockford

General View—Saybrooke Station
Central Illinois Elec. & Gas Co.
Stone and Webster Eng. Corp.
Consulting Engineers

● The illustration above shows the first 30,000 KW unit of a plant which is to be extended into a 110,000 KW station. All coal handling equipment including track hopper and grill, duplex feeder, conveyors, galleries, chutes, tripper and all supporting structures were fabricated in our shops, and installed by us, to Stone and Webster's plans. For efficiency, satisfaction, and fixed unit responsibility, let the Bartlett-Snow coal handling engineers, with their long experience and complete facilities work with you on your next job.

Belt Conveyor from
Track Hopper to Crusher House

View of Crusher House and
Stocking Out Conveyor

DESIGNERS
ENGINEERS

BARTLETT-SNOW
CLEVELAND 5, OHIO

FABRICATORS
ERECTORS

"Builders of Equipment for People You Know"

Specify GLOBE for the finest steel tubes

Specialized research, engineering and production assure uniform high-quality STEEL TUBES

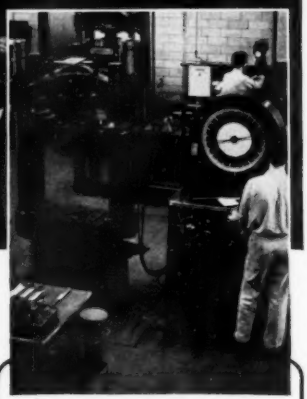
AT Globe, specialization is the keynote. Men, machines, and raw materials are all tailored to fit the Globe *specialized* process. Precision checks — and rechecks — at every stage of production insure Globe Tubes that meet *your* exacting specifications.

Be sure! Specify dependable, high-quality Globe Steel Tubes and be certain of getting the finest tubes available. Write for the General Catalog and become acquainted with Globe *specialized* process.

GLOBE STEEL TUBES CO., Milwaukee 46, Wisconsin

Chicago • Cleveland • Detroit • New York • Houston • St. Louis
Denver • San Francisco • Glendale, Cal. • Philadelphia

GLOBE TUBES



Globe's Physical Testing Laboratory — one of the seven different research and testing labs in Globe's House of Science.

GLOBE STEEL TUBES ARE AVAILABLE IN:

• Stainless Steels — Globe seamless • High Purity Iron — Globeiron • Stainless Steels Gloweld Welded • Corrosion Resistant Steels • Alloy Steels • Carbon Steel • High-Temperature Service Steels • Standard and Special Analysis Steels • Mechanical and Pressure Tubing

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UNARCO
WAREHOUSING
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INSULATIONS
IN STOCK

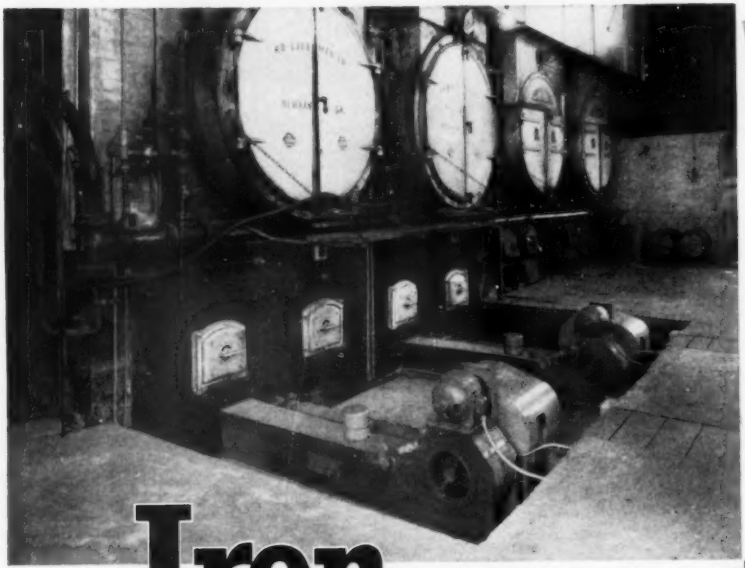
From coast to coast, from north to south, Unibestos is winning new friends. First, because this quality product is so economical, efficient, long-lasting. Second, because—wherever you are—there's a reliable distributing organization ready to supply you from stock. For temperatures up to 1200° F., specify Unibestos No. 1200. Ask for Unibestos No. 750 when the temperature won't go over 750° F. And, for needs up to 600° F., you can get Unarco Amocel from these same Warehousing Distributors. Unibestos is made in cylinders, half-rounds, and blocks. If you don't know your nearest Unarco Distributor, we'll be glad to send you his name. Please ask us, too, for Bulletin 76-109.

UNARCO

UNION ASBESTOS & RUBBER COMPANY

DEPT. C-6, 332 SOUTH MICHIGAN AVENUE • CHICAGO 4, ILLINOIS

"Iron Fireman saves over $5,800 a year at Reeves Brothers' Chesnee (S.C.) Mill"



says William C. Ariail, Jr.
Supt. of the Plant

"Firing automatically adjusted to the load gives us peak steam production when needed and eliminates excess firing during low demand," says Mr. Ariail. "Fuel costs dropped from $13,416 to $10,400 a year. Total savings, including labor are $5,805."

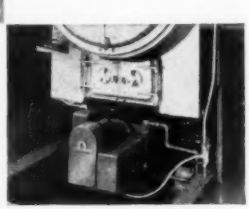
Two Iron Fireman underfeed Coal-Flow stokers in Reeves Brothers textile mill, Chesnee, S. C. Coal is fed directly from main bunkers without manual handling. Steam is used for both heating and processing.

Iron Fireman

The stoker with the modulated fire and built-in coal conveyor

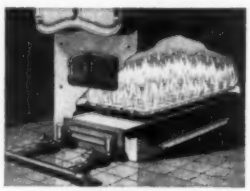
Coal flows automatically from the bunker to the fire, without the cost of manual handling or use of expensive auxilary conveyors. Equally important, its flow is scientifically regulated to provide the exact amount of heat required to maintain the boiler pressures or temperature you require. At the same time the rate of air supply is constantly adjusted to the coal feeding rate.

Important savings are the result of combining this efficient firing with automatic fuel handling. You cannot afford to decide on new firing equipment without considering Iron Fireman.



Iron Fireman Rotary Oil Burner

Fires low-cost, heat-rich heavy oils (No. 5 and No. 6) with complete dependability, regardless of viscosity changes. A real money saver. Capacities up to 500 boiler horsepower.



Iron Fireman Commercial Gas Burner

Vertical type is illustrated above. Others include Radiant Inshot and Ring types. Flexible operation, easy to install. Capacities to 500 boiler horsepower.

MAIL COUPON FOR FULL INFORMATION

IRON FIREMAN MANUFACTURING CO., 3248 W. 106th St., Cleveland 11, Ohio.

Please send literature as checked:

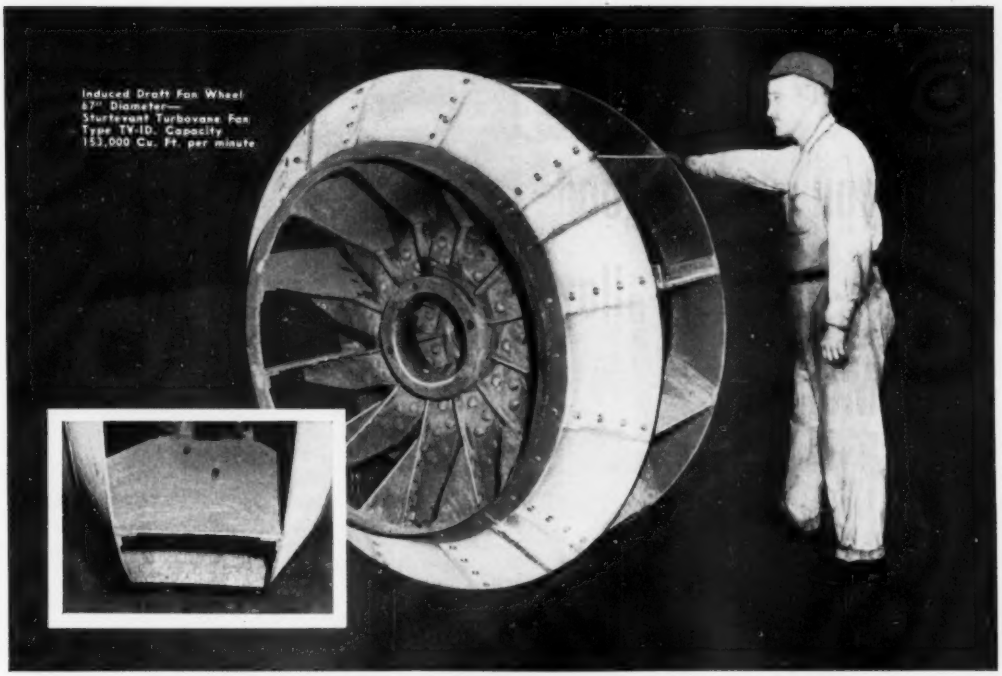
- ☐ Coal-Flow Stoker
- ☐ Rotary Oil Burner
- ☐ Commercial Gas Burner

Name_____

Address_____

City_____

State_____



LIFE OF ID FAN BLADES HARD-FACED WITH COAST METALS ALLOY INCREASED FROM 4 to 12 MONTHS

2 Weeks Boiler Outage Eliminated With CM-112 Alloy

Maintaining this 67" induced draft fan wheel at New Jersey Power & Light Company's Gilbert Station in Holland, N. J. always meant one week of boiler outage three times a year. Labor involved in removing the wheel, changing over and reblading took two weeks for each overhaul. Now this is done only *once a year* by hard-facing the fan blades with Coast Metals Alloy 112. This has reduced downtime better than 66% and eliminated 2 weeks of boiler outage at the station.

Fly ash in the exhaust handled by the fan not only wears down the blades but also attacks the junction points of the blades and shrouds weakening the assembly. In this severe case of abrasive action, CM-112 applied to the major points of wear has increased equipment life better than 3 to 1. Coated with 250 pounds of CM-112, the fan lasts one year before major overhaul. Minor touchups during the year are made while the fan wheel remains in the housing . . . on the job.

After one year of operation, the fan wheel can be refaced again . . . this time with about 60% less than the amount of CM-112 used in the initial hard-facing, resulting in a further reduction in maintenance costs.

There are many other examples of how CM Alloys extend the life of power plant equipment subject to impact and abrasion: Raymond Bowl Mill parts—coal feeder screws — sluice liner castings — clinker crusher rolls—impact mill plows—ID fan float liner plates, exhauster fan blades, when hard-faced with CM *stay on the job* and continue to perform efficiently *long after* unfaced parts have become too worn to use and must be replaced.

So don't *replace — reface* with CM specialized welding rods. You'll not only keep your plant running with fewer interruptions, but save money. We shall gladly make recommendations based on your particular needs.

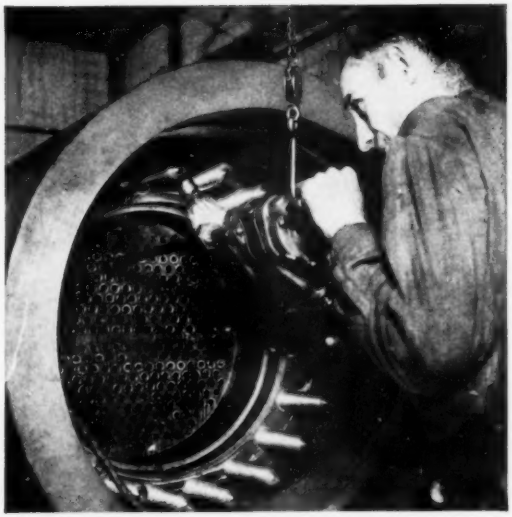
COAST METALS, Inc.

Little Ferry, N. J.

COAST METALS (CANADA), LTD., Hamilton, Ontario

PRODUCERS OF SPECIAL HARD-FACING ALLOYS FOR THE POWER INDUSTRY

When you need a good general-purpose alloy —try Monel!



Expanding Monel tube into the head of a high-pressure feed-water heater. Here's an example of where Monel's high ductility combines with its other characteristics to make it the perfect metal for the application.

Today, even the most "up-to-the-minute" metallurgist finds it hard to keep pace with all the alloys and their many applications.

But, in the power field, there is one general-purpose alloy with sufficient all-round usefulness to solve a number of metal selection problems – pump shafts, impellers, valve seats and stems, to name a few.

That alloy is Monel®!

Monel is a solid solution alloy with good strength (twice that of brass and equal to structural steel). And it retains its strength at operating temperatures of 700-800° F.

It has good resistance to corrosion, cavitation and erosion. And its high ductility provides good workability. It is supplied in all general mill forms as well as in castings.

You can get some idea of how useful Monel can be when you consider just one application –high-pressure feed-water heater tubes–where it proves to be the *only* answer.

Here's a job that calls for a strong, corrosion-resisting metal with good heat transfer properties and high resistance to erosion and cavitation. In addition, the metal must be capable of standing operating pressures up to 3,000 pounds per square inch and even higher.

Monel meets *all* these requirements!

There are all kinds of applications in which this versatile alloy can be helpful. For more information on its characteristics and uses, write for Technical Bulletin T-5, "Engineering Properties of Monel and 'R' Monel."

And remember, defense production still uses up a lot of Monel. Therefore, it's on extended delivery so it will pay you to anticipate your needs and order well in advance. Be sure to include NPA rating and complete end-use information.

The International Nickel Company, Inc.

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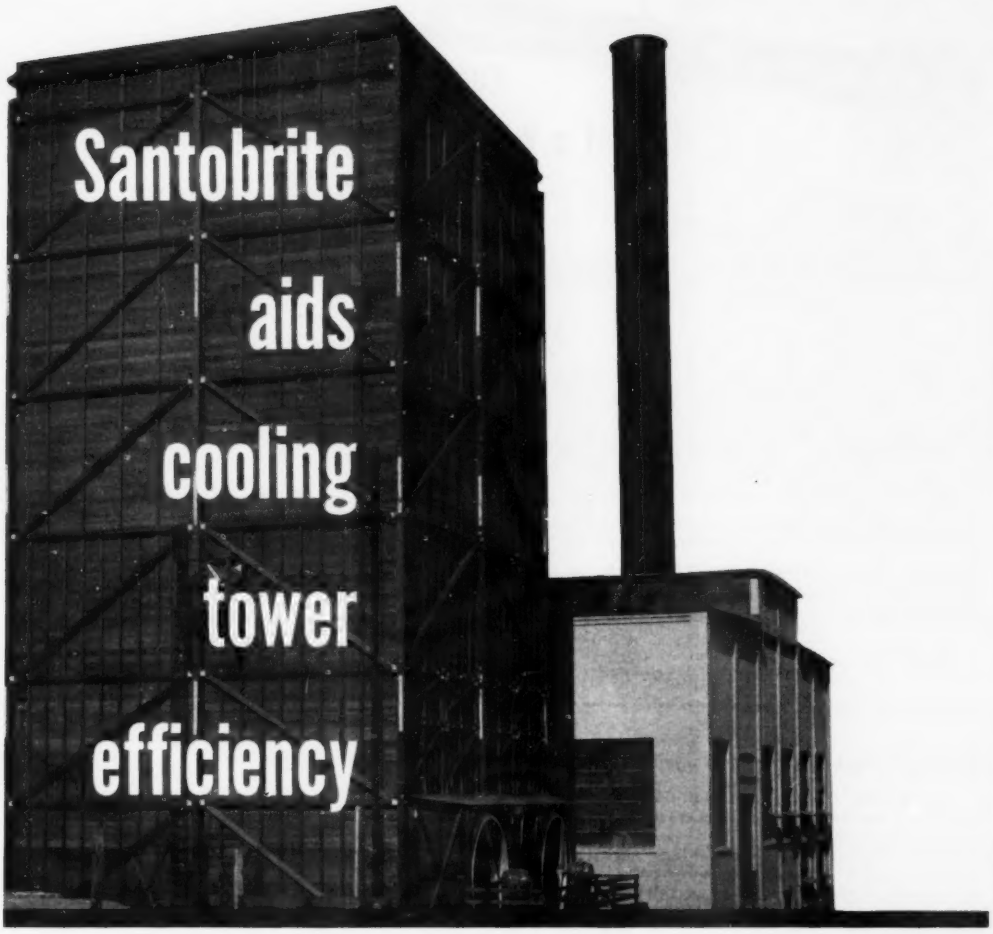

Your cooling towers will be more efficient . . . and maintenance costs will be lowered . . . by the elimination of slime and algae. Monsanto Santobrite, in years of service, has proved its effectiveness and economy.

Five to 10 parts per million, at 25-35° C. and at pH of around 7.0, will kill siliceous algae. Five to 15 parts per million destroys green algae. Blue-green algae are eliminated with 10 to 20 parts per million of Santobrite.

Santobrite (sodium pentachlorophenate, technical) is water soluble. It can be applied easily and without expensive special equipment. Santobrite is available in powder, pellet and briquette form.

For information on the use of Santobrite to cut down cooling tower operating costs while stepping up efficiency, contact the nearest Monsanto Sales Office or write MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, 1700 So. Second Street, St. Louis 4, Missouri.

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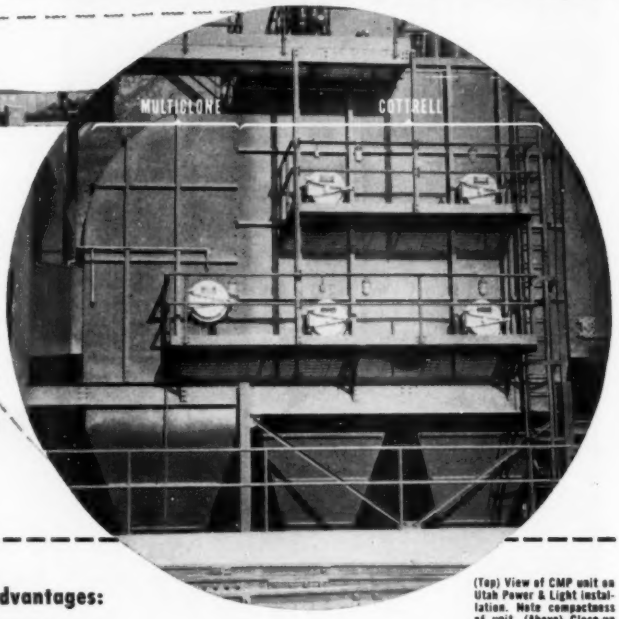
Planning A Fly Ash Recovery Installation?

Consider these important advantages of a WESTERN PRECIPITATION CMP UNIT!



(Top) View of CMP unit on Utah Power & Light installation. Note compactness of unit. (Above) Close-up of same installation.

IF YOU are planning the installation of any type of fly ash recovery equipment—mechanical or electrical—it will pay you to investigate the extra advantages to be gained by installing a CMP Unit designed, engineered and constructed under *one* responsibility by Western Precipitation Corporation—*leaders in both electrical and mechanical recovery fields!*

Combines Mechanical and Electrical Advantages:

A CMP (Combination Multiclone-Cottrell Precipitator) Unit combines—in one compact installation—both mechanical and electrical recovery principles, so that maximum benefit is obtained from the advantages inherent in each method. The MULTICLONE section centrifugally cleans the gases of the larger and heavier fly ash particles (down to a few microns in diameter)... and the COTTRELL Precipitator then electrically removes the very small particles remaining in the gases. This combination arrangement has important advantages:

1. Using the MULTICLONE for cleaning out the heavier particles permits the bulk of the recovery operation to be performed with relatively low-cost equipment.

2. Using the COTTRELL for final clean-up insures unusually high recovery efficiency—approaching theoretically perfect, if desired—with a high efficiency, compact Precipitator unit.

3. Each type of unit—MULTICLONE and COTTRELL—can be arranged for its most efficient application. MULTICLONES may be connected to each separate boiler, if desired, and their draft requirement cut out when the boiler is down... while a central COTTRELL handles all gases and operates at higher efficiencies, with continued low power cost, when one or more boilers are down.

4. During soot-blowing periods, or while warming up cold boilers, the MULTICLONE efficiency usually increases, preventing overloads of detrimental carbon from reaching the COTTRELL.

Only Western Precipitation Combines Multiclone and Cottrell "Know-How"—In ONE Organization!

A vital factor in obtaining maximum efficiency and economy in CMP installations is the proper balance of mechanical and electrical recovery equipment to the individual requirements of *each* application. Western Precipitation is unique in that it not only pioneered the commercial application of COTTRELL Electrical Precipitators over 43 years ago, but also has been a leader for many years in the *mechanical* recovery field with its widely-recognized MULTICLONE Collectors.

Result—Western Precipitation has the all-important "know-how" and experience in BOTH fields... knows from first-hand experience how to fit the *right* equipment in the *right* place, to do *your particular* job ... and can provide the complete installation under ONE responsibility and ONE overall guarantee!

Let Our Experienced Engineers study your recovery requirements and make recommendations on the equipment best suited to your operations. A wire, phone call or letter to our nearest office places this unique "Know-How" at your service, without obligation!

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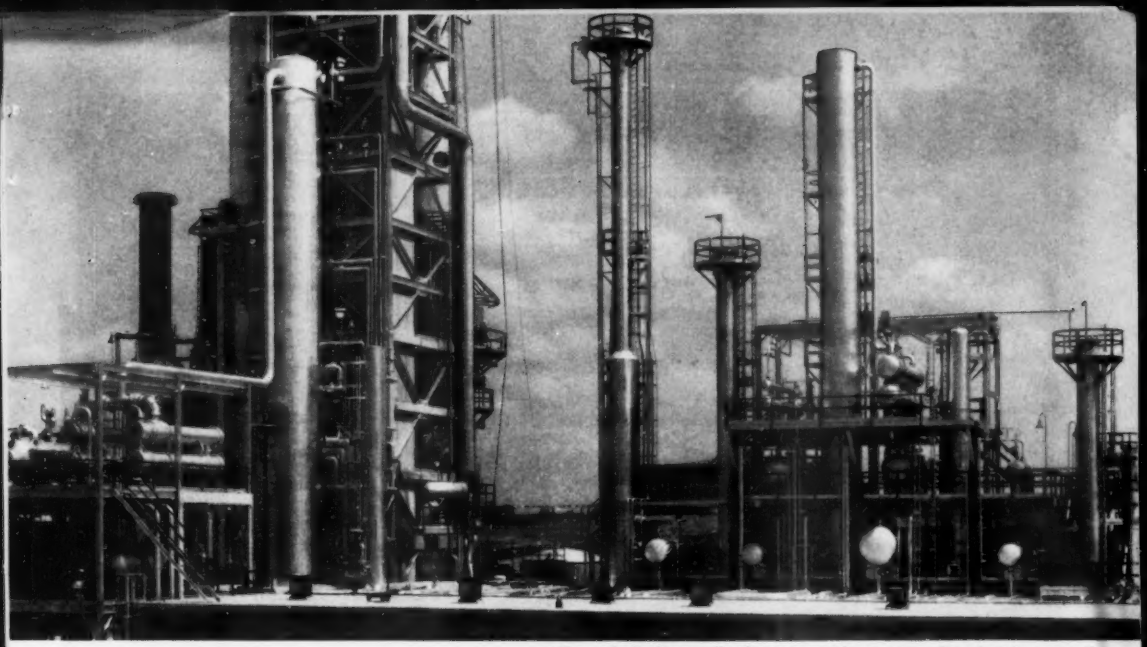
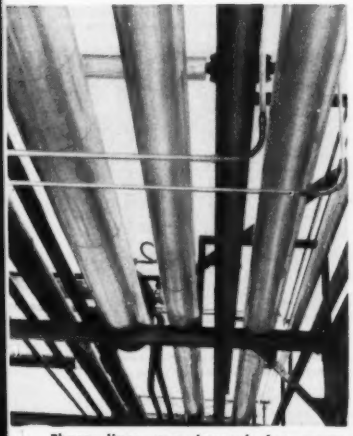


Refineries cut maintenance on insulated lines by switch to new low-cost aluminum jacketing

"It cut jacketing application costs, and we expect it to last for years," report engineers at refineries everywhere after testing Childers Aluminum Jacketing on their insulated lines. This new Oklahoma refinery used Childers 100% — on towers and vessels (in heavy weight) as well as on lines. It is flexible and easy to put on, and this 35 alloy aluminum is tough and weather-resistant, even in corrosive industrial atmospheres. This is the first and only jacketing especially engineered for process plants and power installations.

At least 567 processing plants have installed and tested this new Childers Aluminum Weatherproof Jacketing during the last three years. You can examine its advantages for your plant by writing for a free sample. Address Childers Manufacturing Co., Dept. PO-3, 3620 W. 11th St., Houston 8, Texas.



These lines are insured for years against wear and weather. They'll never need painting because Childers Jacketing gives them all the advantages of appearance and long life that come only with weather-resistant aluminum. Yet this specially engineered jacketing costs far less than would heavy aluminum sheets.

As shown here, Childers Jacketing can be attached with no more tools than a pliers and a wooden wedge. No expensive shop work or pre-forming are necessary. Several methods of attaching are available, but aluminum bands shown here are probably best and cheapest. Because this jacketing is so easy to handle and so simple to attach, it cuts installation costs way down.

This is how the flexible, easy-to-handle Childers Jacketing arrives at the job site. It is in convenient rolls 4 feet wide and 100 feet long—just right for one man to handle—and is available either with or without a moisture barrier attached on the back of the .006" aluminum "skin". It can be cut to proper lengths using any flat table and a straight-edge.

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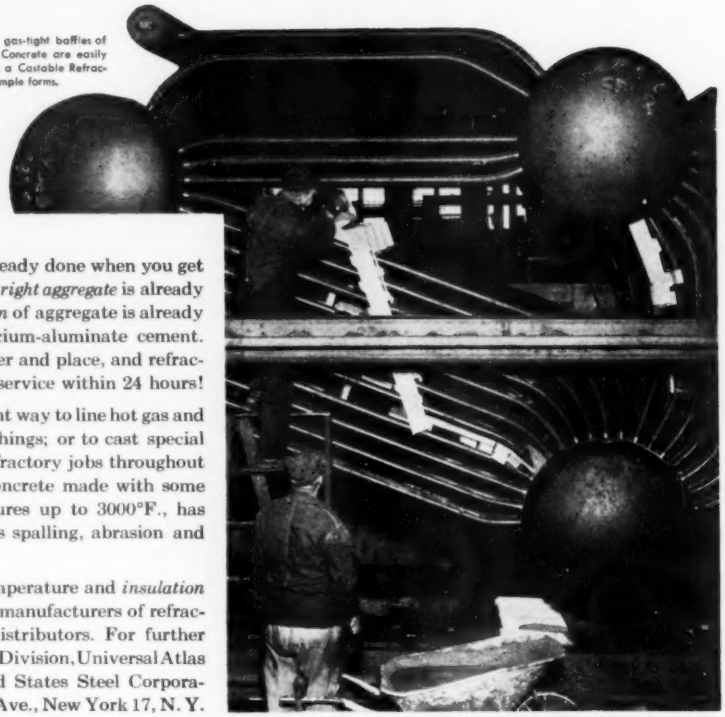
Under CMP regulations, Childers is a Class B product, the use of which is not restricted.

CASTABLES give you a *head start* on your next Refractory job

Monolithic, gas-tight baffles of Refractory Concrete are easily made with a Castable Refractory and simple forms.

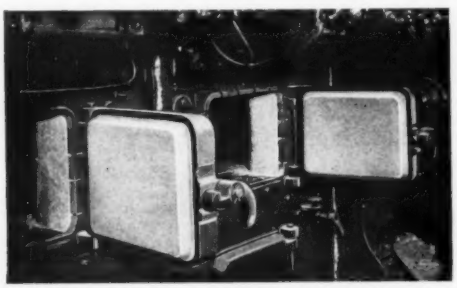


TWO PARTS OF THE JOB are already done when you get Castable Refractories. The *right aggregate* is already selected. The *right gradation* of aggregate is already mixed with Lumnite* calcium-aluminate cement. All you do is mix with water and place, and refractory concrete is ready for service within 24 hours!

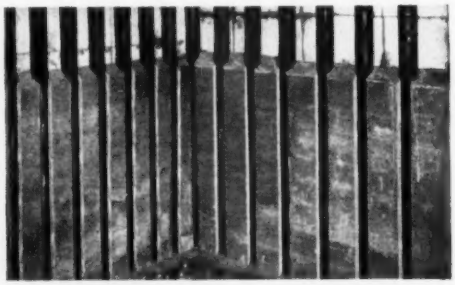
That's the fast, convenient way to line hot gas and air ducts, stacks and breechings; or to cast special shapes . . . and do many refractory jobs throughout your plant. Refractory Concrete made with some Castables takes temperatures up to 3000°F., has low volume change, resists spalling, abrasion and corrosion.

CASTABLES to meet specific temperature and *insulation* requirements are made by manufacturers of refractories and sold by their distributors. For further information, write Lumnite Division, Universal Atlas Cement Company (United States Steel Corporation Subsidiary), 100 Park Ave., New York 17, N. Y.

Packaged Castables used in these jobs were made by Mexico Refractories Company, Mexico, Mo.



DOOR LININGS made with adaptable Castable Refractory Concrete. Unnecessary to stock large inventories of special shapes. Instead, special shapes can be cast in place or poured in molds as needed. Volume change is negligible.



TUBE PROTECTING Water Wall Studding made with a Castable Refractory is tough and highly radiant, uses a different aggregate than baffles (above). With Castables you get Refractory Concrete tailor-made for the job.

**"LUMNITE" is the registered trade mark of the calcium-aluminate cement manufactured by Universal Atlas Cement Company.*

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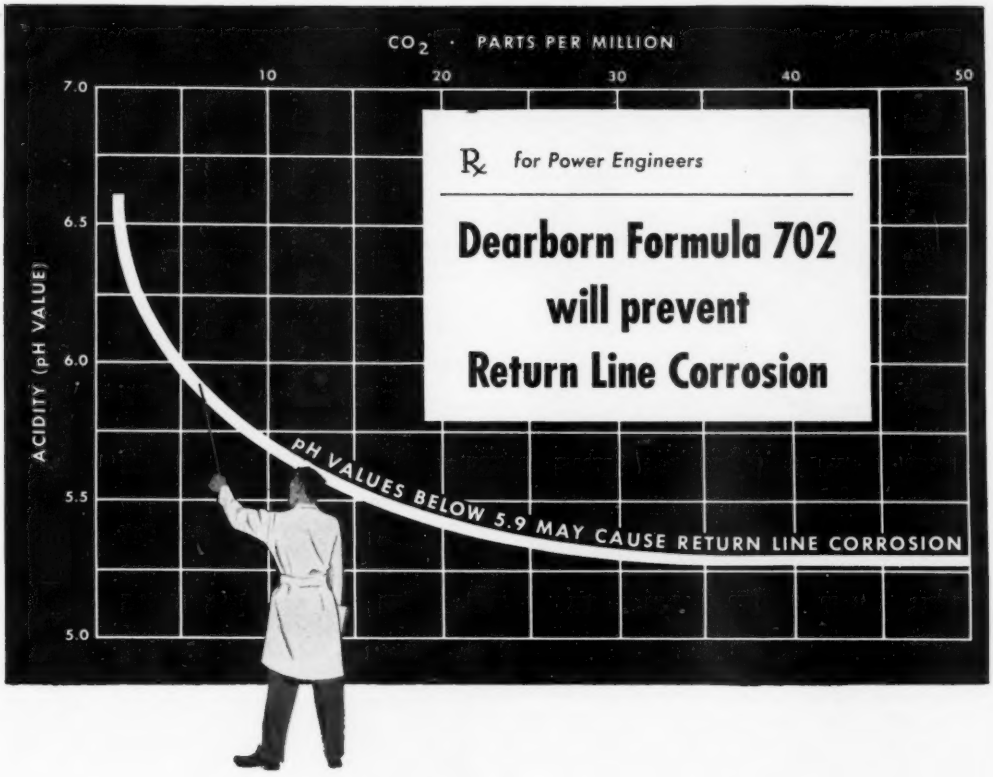

What's the pH value of your boiler feed water? Chances are that if it's 5.9 or lower, you have return line corrosion—caused by excessive quantities of dissolved carbon dioxide and oxygen.

Corrosion caused by a low pH is effectively prevented with Dearborn Formula 702. This effective Dearborn treatment, which is introduced directly into the boiler feed water, works three ways. First, it forms a continuous amine film on the return lines to prevent corrosion. Second, this same film improves heat transfer, thus lowering the cost of steam production. Third, Formula 702 will automatically repair the film broken by rust scale separating from the pipe.

It will pay you to learn more about how Formula 702 will reduce excessive maintenance, avoid shutdowns, protect valuable equipment. Why not call your Dearborn Engineer today?

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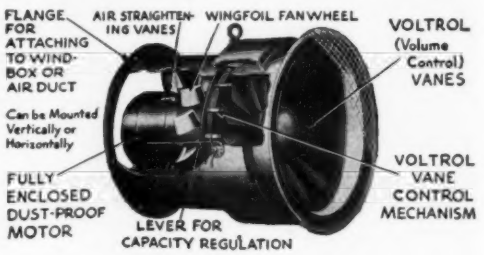
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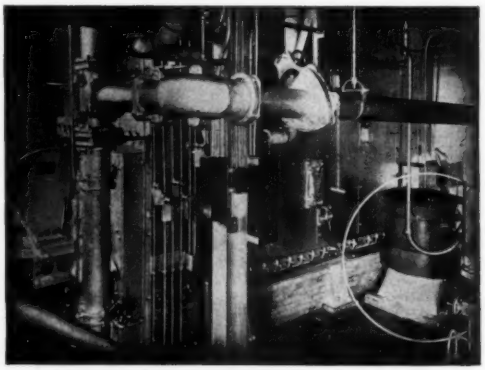

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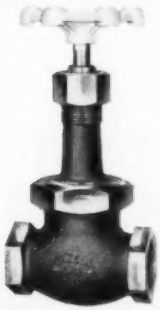

Fig. 2608—200-pound Bronze Globe Throttling Valve. Designed to permit full flow through the seat when wide open. Has special bronze stem and stainless steel disc and seat hardened to approximately 500 Brinell.

Fig. 1331-A—Steel Integral Bonnet Offset Globe Valve for 1500-pounds W. P. Socket weld ends. Sizes ½" to 2", incl.

Fig. 1314-A—1500-pound Steel Integral Bonnet "Y" Valve with socket weld ends. Sizes ½" to 2", incl.

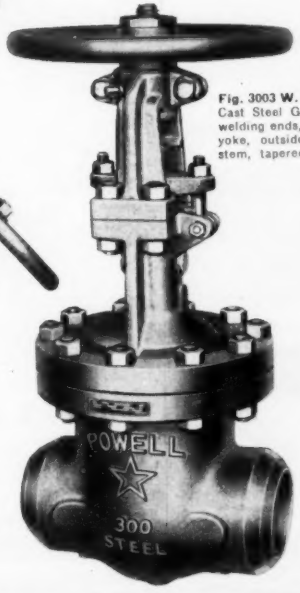

Fig. 3003 W. E.—300-pound Cast Steel Gate Valve with welding ends, bolted flanged yoke, outside screw rising stem, tapered solid wedge.

Fig. 1793—Large 125-pound Iron Body Bronze Mounted Gate Valve. Made in sizes 2" to 30", inclusive. Has outside screw rising stem, bolted flanged yoke and tapered solid wedge.

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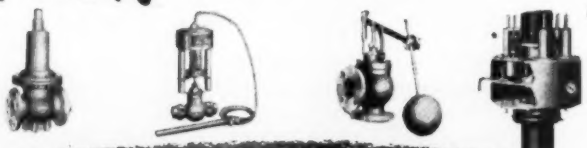

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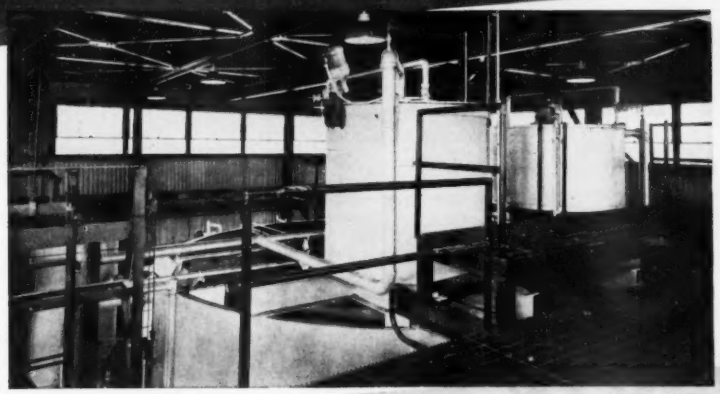
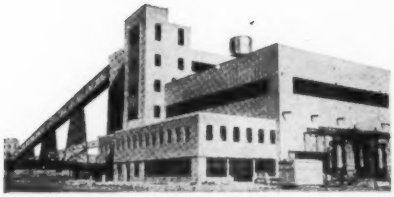
UP TO 2000 PPM



Portion of installation of Graver Reactivator, 23 ft dia. x 13 ft high, at Plant Yates of Georgia Power Co. View from operating platform.

Consistent Clarified Water Turbidity

BELOW 10 PPM



at Plant Yates

GEORGIA POWER CO.

The turbidity of the Chattahoochee River at Plant Yates varies widely and is frequently as high as 2000 ppm. Also, the pH sometimes varies rapidly between 6 and 8.

But this combined clarification and stabilization problem presents no difficulties to the Graver Reactivator, which produces 400 gpm of clear water with a turbidity consistently below 10 ppm and with pH automatically controlled within specified limits through all the variations in the raw water supply.

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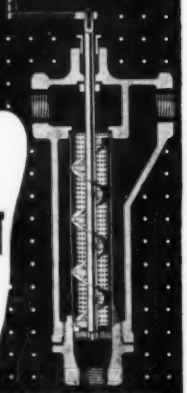

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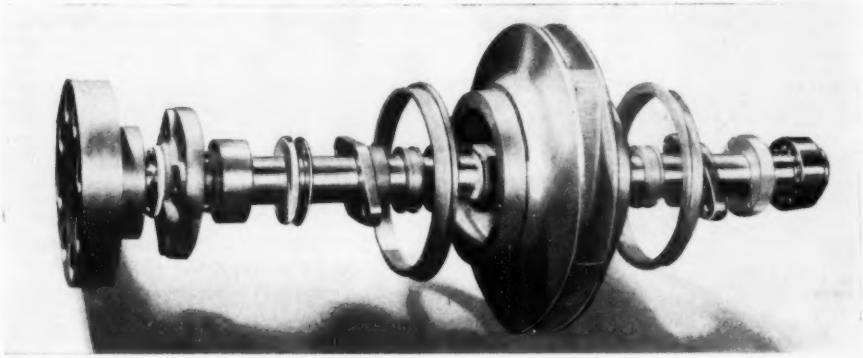
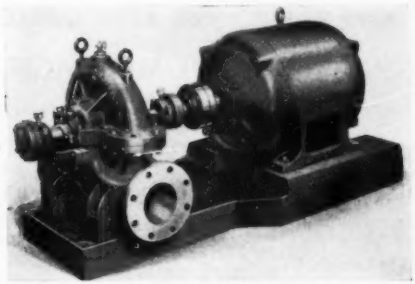


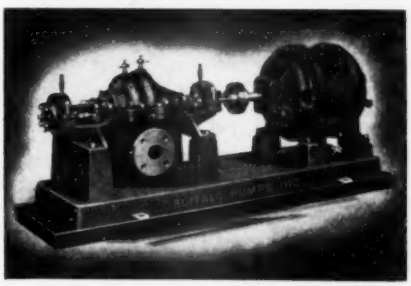
The impeller, being the part of the pump that moves the liquid, is naturally subject to the most punishment in the form of shock, abrasion or corrosion, depending on the hydraulic conditions.

Above is the rotor and shaft assembly of a "Buffalo" Type "SL" Double Suction Pump for clear water service. The shaft is oversize. It is machined of high grade steel, bronze covered, or solid monel metal or other alloy. The bronze impeller is mounted on an enlargement of diameter at the center of the shaft and secured by feather key and lock nuts. The impeller is hydraulically balanced—always receiving water from opposite sides in equal volume and pressure. The entire assembly is also in perfect dynamic balance for vibrationless performance. Such an impeller is not only highly efficient in its liquid handling, it is built to stand continual service. Another example of heavy-duty, high-efficiency construction is the popular "RR" pump shown at left. Available in 2 and 4 stage models for pressures up to 500 lbs., it is widely used for boiler feed and other clear water service.

FOR ALL ENGINEERING DATA on "Buffalo" clear water pumps, write today for Bulletins 980 and 955-P.



"Buffalo" Type "SL" Pump



"Buffalo" Type "RR" Pump

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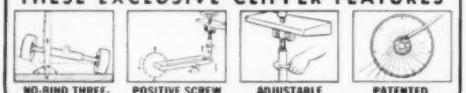

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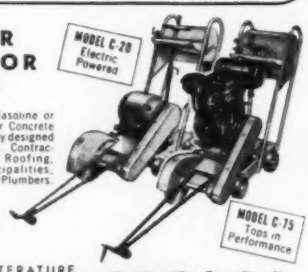

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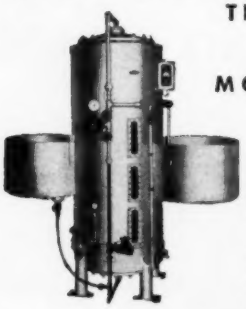

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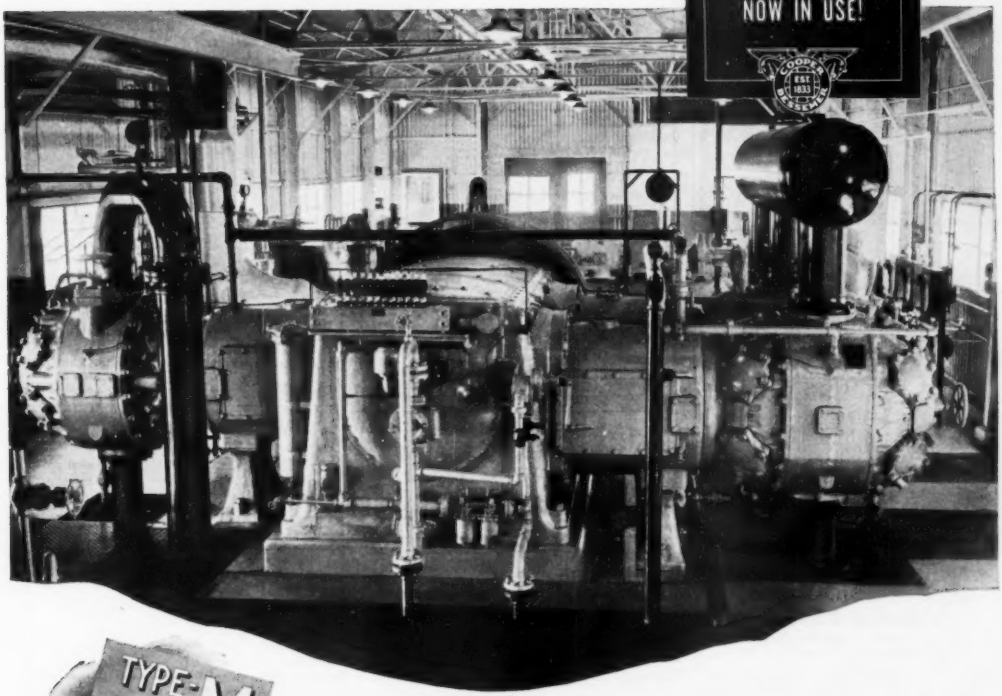

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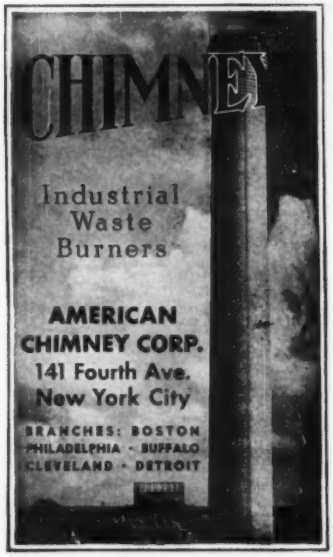

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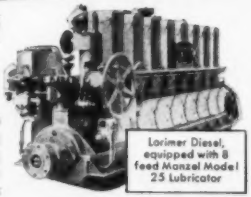

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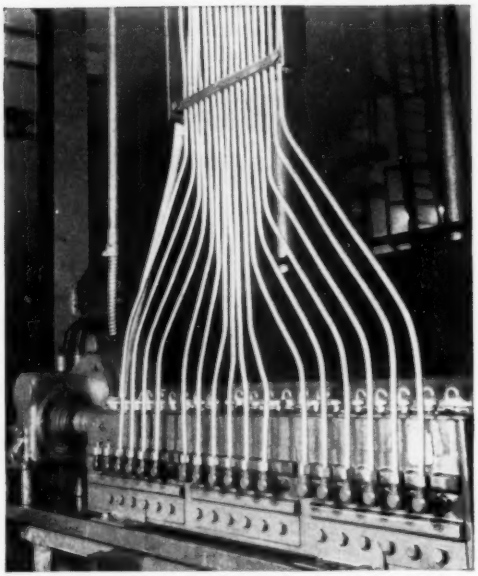

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Experienced Engineers and recent or prospective 1952 and 1953 graduates required for steam power plant expansion program in Engineering Department. Work offers permanent employment with ample opportunity for advancement for men with ability and initiative.

Pleasant, congenial suburban community, having the advantage of proximity to a metropolitan area.

Write, giving full particulars of education, experience and salary to:

Box P-3650, POWER
330 W. 42nd St., New York 36, N. Y.

When required, personal interviews will be arranged for evenings or Saturdays.

OPPORTUNITY
FOR
Deaerating Heater Engineer

Large well established company offers desirable position to an engineer thoroughly familiar with the design and operation of deaerating heaters to take charge of this department of the company. Location, New York City. Salary commensurate with qualifications.

Write full particulars of experience and personal data.

P4256, POWER
330 W. 42nd St.
New York 36, N. Y.

New England Boiler Setting Co.
Specialists on
FIRE BRICK CONSTRUCTION
Industrial Furnaces
Expert Repairing
Stephen S. Donoghue
106 Webster St. **Arlington 74, Mass.**

FOR SALE OR LEASE

Complete foundry facilities. Specializing in boiler stoker, grates and accessories, foundry, pattern, machine shop and storage areas 50,000 sq. ft. RR siding. Midwest location.

Inquiries Invited.

POWER ENGINEER
P.O. Box 419
SOUTH BEND, IND.

ELECTRIC MOTORS AND GENERATORS

WAGNER CERTIFIED REBUILT

BACKED BY 46 YEARS OF QUALITY AND SERVICE

MAKE OUR SLOGAN YOURS - - - "Check with WAGNER First!"

OVER 46 YEARS OF EXPERIENCE is back of every machine sold by Arthur Wagner Company. Large stocks and modern facilities insure ample choice and prompt service at reasonable cost. All Wagner "Certified Rebuilt" equipment conforms to standards approved by National Industrial Service Association. Inspect our shop and stock—see why it pays to . . . "Check with Wagner First!"

M-G SETS

KW	Mfr.	Input V	Output V
500	Whse.*	2300 AC	250 DC
500	G.E. HCC conv.	2300 AC	275 DC
300	Allis Ch.	2200/440 AC	125/250 DC
300	Whse.*	2300 AC	600 DC
200	Whse.*	2300 AC	275 DC
200	Gen. Elec.*	220/440 AC	125 DC
150	Whse.*	2300 AC	275 DC
150	Whse.*	220/440 AC	125/250 DC
105	Century b.b.	220/440 AC	70 DC
100	Whse.*	220/440 AC	250 DC
100	Deko b.b.	220/440 AC	125/250 DC
100	Allis Ch.	220/440 AC	125 DC
100	Allis Ch.*	220/440 AC	50 DC
75	Gen. Elec. (2)	220/440 AC	250 DC
60	Gen. Elec.*	220/440 AC	60 DC
50	Allis Ch. (2)	220/440 AC	125/250 DC
50	Whse.	2200/440 AC	250 DC
45	Gen. Elec.*	220/440 AC	60 DC
45	Gen. Elec.	220/440 AC	60 DC
40	Whse.	220/440 AC	125 DC
40	G.E.	220/440 AC	250 DC
35	Cr. Wh. b.b.	220/440 AC	125 DC
30	Elec. Prod.	220/440 AC	50 DC
25	Whse.	220/440 AC	125 DC
25	G.E. b.b. New	220/440 AC	125 DC
25	Reliance b.b.	220/440 AC	250 DC
20	Norlin'n	220/440 AC	250 DC
15	G.E. (2)	220/440 AC	125 DC
15	Star b.b. (3)	220/440 AC	250 DC

*Syn. motor drive.

D. C. MOTORS

HP	Mfr.	Type	Volts	Speed
300	Gen. Elec.	MPC	230	500
200	Reliance	1400T	230	850
175	Gen. Elec.	RC	230	1650
150	Gen. Elec.	MPC	230	500/1200
150	Whse.	SK183	230	1150
100	Gen. Elec.	C	230	575/1000
75	Gen. Elec. (2)	CD115	230	1150
60	Cr. Wh.	56H	230	700
60	Reliance b.b.	654T	230	750
50	Gen. Elec.	RLC 291	230	500/1200
50	Gen. Elec.	LC	115	400/800
40	Whse.	SK	230	850
40	Gen. Elec.	RC 32	230	1150
35/50	Gen. Elec.	CD-123	230	575/1150
30	Whse.	SK116L	230	1150
30	Whse. (2)	SK90	230	1760
30	Star b.b.	SB	230	1750
30	Gen. Elec.	RC33	230	775
25	Gen. Elec.	CD85	230	1750
25	Whse.	SK150	230	500/1200
25	G.E. b.b. New	CDM93	115	1150
25	Whse.	SK	230	1150
25	Reliance b.b.	92T	230	1150
20	Whse.	SK130	230	500/1150
20	G.E. b.b. (5)	CDM83	230	1150
20	Whse. b.b. (2)	SK87	550	900
20	Gen. Elec. (2)	CD83	230	1750

- **EXPLOSION PROOF MOTORS—**
- **GEARHEAD MOTORS, AC & DC**
- **FREQUENCY CHANGERS**
- **CIRCUIT BREAKERS, AC & DC**
- **SPEED REDUCERS**

D. C. GENERATORS

KW	Mfr.	Type	Volts	Speed
300	Gen. Elec.	MPC	275	700
300	Whse.	SK	600	900
150	Whse.	SK191	125/250	900
127	Gen. Elec.	RC58	250	675
105	Century b.b.	1500 amp.	70	1200
100	Gen. Elec.	C	250	750
100	Allis Ch.	E	125	1200
75	Gen. Elec.	CD	250	1500
60	Gen. Elec.	LC	250	700
50	Allis Ch. (2)	EW	125/250	1200
50	Cr. Wheeler	56H	250	900
40	Whse.	SK	250	1200
40	Gen. Elec. (2)	RC32	250	1500
20	Gen. Elec.	RC32	250	1200
25	G.E. b.b. New	CDM93	125	1750
25	Whse.	SK	250	1450
20	Gen. Elec. (2)	RC	125	1150
20	Gen. Elec. b.b.	CDM	250	1750
15	Cr. Wheeler b.b.	CCD	125	1100
15	Star b.b. (5)	SQ	250	1500

A. C. GENERATORS — 60 CYCLE

KVA	Mfr.	Type	Volts	Speed
1000	Whse. syn. cond.		4000/2300	900
625	Gen. Elec.	ATB	2300	450
625	G.E. 25 cycle	ATB	2300	750
500	El. Machy.		480	900
485	Allis. Ch.	1 brg.	480	600
312	Gen. Elec.	ATB	240/480	600
275	G.E. 25 cycle	ATI	480	750
250	Whse.	G	2400/480	600
225	Gen. Elec.	ATB	2300	900
225	Gen. Elec.	ATB	240/480	600
150	Whse.		2300/480	600
125	Gen. Elec. (2)	ATB	240/480	900
112	Gen. Elec.	ATB	240/480	900
90	Gen. Elec.	ATI	240/480	1200
75	El. Machy.		2300	900
56	Gen. Elec.	ATB	240/480	1200
31	Whse. b.b.	late	120/208	1200
10	Kato New (15)	b.b.	127/220	1800

A. C. MOTORS — SLIP RING
3 Phase 60 Cycle 220 or 440 Volts

Qu	HP	Mfr.	Type	Speed
1—	800	G.E. 2300/4000V.	MT	600
1—	500	G.E. 2 brg.	I-M	450
1—	400	Gen. Elec.	I-M	514
1—	350	Gen. Elec.	IM-17A	720
1—	350	Whse. 2200V.	CW	450
1—	300	G.E. 2300V.	I-M	1800

1—	200	Allis Ch.	ANY	360
1—	250	Allis Ch. 2200V.	ANY	514
1—	250	Cr. Wheeler	SR	600
1—	200	F. Morse b.b. 2200V.	HV-24C	900
1—	200	Gen. Elec.	IM-17	514
1—	200	Gen. Elec.	I-M	360
2—	200	Gen. Elec.	I-M	600
1—	150	G.E. 2200/4400V. Vert.	I-M	1200
1—	150	Gen. Elec.	IM-17	450
1—	150	Allis Ch. 2200V.	IM-16	600
1—	150	Gen. Elec.	ANY	720
1—	125	Gen. Elec. 2200V.	IM-15	720
1—	125	Fair. Morse b.b.	HV246B	600
2—	125	Gen. Elec.	I-M-15	600
1—	125	Allis. Ch.	ANY	900
1—	125	Gen. Elec. 2200V.	I-M	450
1—	100	Whse.	CW856	900
2—	100	Gen. Elec.	MT556	900
2—	100	Gen. Elec.	I-M	514
2—	100	Gen. Elec.	I-M	1800
2—	100	G.E. 2200V.	MT553	1200
1—	100	G.E. Vertical	MT553	1200
1—	100	Cr. Wheeler	SR	600
1—	75	Gen. Elec.	MT558	600
2—	75	Gen. Elec.	MT552	900
1—	75	Whse. 2200V.	CW	600
2—	75	Gen. Elec.	MT343	1800
1—	75	Whse.	CW	720
2—	60	Gen. Elec.	MT533	1800
1—	60	Allis Ch. b.b.	ARY	720
2—	60	Gen. Elec. enclosed	I-M	514
1—	60	G.E. TEFC b.b.	M-6326	720
1—	60	Whse. 2200V.	CW716C	900
2—	50	Gen. Elec.	MT542	900
2—	50	Gen. Elec.	MT556	600
2—	40	Whse.	CW636A	1200
1—	30	G.E. int. duty	MTC5312	1200
2—	30	Gen. Elec.	MT326	1200
2—	30	Gen. Elec.	MT332	900
1—	25	Gen. Elec. int.	MTC5326	720
3—	20	Whse. b.b. New	CW364	1800

A. C. MOTORS — SYNCHRONOUS

HP	Mfr.	Type	Volts	Speed
750	Whse. SPF	Cond.	4000/2200	900
200	Gen. Elec.	TS7659	2200	514
500	Allis Ch.	SPF	440	600
450	Whse.	SPF	2300	900
300	Whse.	G	2200/440	600
275	G.E. 25 cycle	ATI	220/440	750
225	El. Machy.	BHKT	220/440	1800
220	G.E. 3 brg. SPF	ATI	220/440	600
220	G.E. SPF	ATI	2200	900
200	G.E.	TSS	220/440	150
190	El. Machy.	3 brg.	220/440	514
175	Gen. Elec.	ATI	2200/550	450
175	Whse.	2 brg.	220/440	360
150	Gen. Elec.	ATI	220/440	900
125	El. Machy. (2)		220/440	1800
120	Burke b.b. SPF	AC19	2200/440	1200
100	American b.b.	VGH	220/440	720
90	Gen. Elec.	TS7545	220/440	1200
80	Gen. Elec.	ATI	2200/440	1200

A. C. MOTORS — SQUIRREL CAGE
3 Phase 60 Cycle 220 or 440 Volts

Qu	HP	Mfr.	Type	Speed
1—	500	G.E. 6600/4000 V.	I-K	1800
1—	500	Gen. Elec.	CT559	5600
1—	400	Whse. 2200V.	CS	1800
1—	300	G.E. 2200V.	KTP561	1800
2—	250	Whse.	CS	720
2—	250	L. Allis b.b. 2200V.	OGS	1800
2—	250	Whse. 2200V.	CS	1200
1—	250	Gen. Elec.	IK-17	600
1—	250	G.E. 2200/440V.	KT412	400
2—	200	Reliance b.b. New	C6085	1200
1—	200	Whse.	CS	900
1—	200	G.E. 4000/2200/440V.	KT412	360
1—	200	Gen. Elec.	IK-17	514
1—	200	Relance b.b. New	B6085S	1800
2—	200	Gen. Elec.	I-K	600
1—	200	Gen. Elec.	I-K-E3B	1800
1—	150	Gen. Elec.	K558	900
1—	150	Allis Ch. 2200V.	ARW	3600
2—	150	Reliance b.b. New	B5085	1800
1—	150	Gen. Elec.	KT549	1800
2—	150	Gen. Elec. 2200V.	IK-15A	720
1—	150	Reliance b.b. New	B6085	1200
1—	150	Gen. Elec. TEFC b.b.	K6533S	1200
1—	150	Whse.	CS	720
1—	125	Al. Ch. 2200V. b.b.	ARX-824	900
1—	125	Rel. TEFC New	B6085S	1800
1—	125	Gen. Elec.	K-558	900
2—	125	Allis Ch. Vertical	ARV226	1200
1—	125	G.E. New b.b. HT	KG6324	1200
1—	125	Con. 2200V. b.b.	SC	1800
2—	125	G.E. 2200V. TEFC	K6326	3600
2—	100	Reliance b.b. New	5085S	1800
1—	100	Whse.	CS	720
1—	100	Gen. Elec.	IK-15	600
2—	100	Gen. Elec.	IK-14	900
1—	100	Reliance b.b. New	C5085	900
1—	75	Gen. Elec.	KT529	3600
1—	75	G.E. 2200V.	KF546	900
1—	75	Lima b.b.	R8505	1200
1—	75	Whse. Expl. Prf. New	C8505	1200
1—	75	Rel. TEFC New	5048	3600
1—	75	G.E. TEFC 2200V. New	K-6325	900
2—	75	Gen. Elec.	I-K-14	600
2—	75	Reliance b.b. New	CB145S	1800
1—	75	Reliance TEFC	C5084	1200
3—	75	G.E. Vertical	KT543	1200
2—	75	U. S. b.b. NEW	8C505	1200
3—	60	G.E. 2200V.	KT533	1800
2—	60	Gen. Elec.	KT546	900
3—	60	F. Morse b.b.	HO-166B	900
1—	60	Gen. Elec.	KT556	450
1—	60	Reliance b.b. New	C6505	900
1—	60	G.E.	KT556	450
1—	60	Gen. Elec.	I-K	600
3—	60	G.E. Vertical	KT536	1200
2—	60	Reliance b.b. NEW	B504	1800
1—	60	Allis Ch. TEFC	ARZ	3600
2—	50	Howell b.b.	8CBB	3600
2—	50	Gen. Elec.	KT546	720
1—	50	Gen. Elec.	KT552	600
2—	50	G.E. Vertical	KT546	720
1—	50	Star b.b.	N505	1200/720
2—	50	Reliance b.b. New	C6504U	900
2—	50	Whse.	CS	1200
2—	50	Howell TEFC	K445	1800
1—	50	Gen. Elec.	KT547	1800
1—	50	Reliance b.b.	C585	600
1—	50	Whse. hiterq	C8505	900
2—	40	G.E. 2200V.	KT323	1800
2—	40	Reliance b.b. New	CB104	1800
2—	40	Reliance b.b. New	CB365	3600
2—	40	Gen. Elec.	KT532	1200
2—	40	Gen. Elec.	KT346	600
6—	40	Whse. b.b.	C8-504	1200/900
1—	30	Louis Allis	HD	900/450

A. C. MOTORS — 25 CYCLE

HP	Mfr.	Type	Volts	Speed
275	G.E. syn.	ATI	440	750
150	Whse.	HF	440	500
60	Allis Ch.	ARY	440	1500
50	Gen. Elec. int.	MTC5337	440	750
30	Gen. Elec.	MT343	440	750

QUICK SHIPMENT FROM STOCK—
LOW PRICES — FULL GUARANTEE
Send for Complete Stock Lists

CERTIFIED

Arthur Wagner Co.

1435 W. RANDOLPH ST. MOnroe 6-7409 CHICAGO 7, ILLINOIS

WORLD'S LARGEST INVENTORY

Established 1934 — D & B Rated

TRANSFORMERS
WORLD'S LARGEST INVENTORY

KVA	PV	SV
1—6000	24000	5040/4800Y
1—3750	22000	600
1—3750	22000	440
1—3000	22000	440
1—3000	22000	480
1—3000	22000	550
3—2500	27600	2300
4—2000	21000	6800
3—2000	45/50000	2300
5—1500	33000	2300
1—1500	2200	600
4—1000	33000	2300
3—1000	13800	230/460
1—1000	2200	220 Delta
8— 833	2300	575

KVA	PV	SV
2— 833	13800	460
4— 750	2200	244/488
3— 667	13200	2300
1— 667	13200	480
3— 667	6600	2300
3— 500	11400	40/80
1— 500	4600	460
2— 500	11000	2300
1— 450	11000	230
1— 450	11000	460
3— 400	1985	244/488
3— 400	2200	230/460

100 NEW, 15 KVA, Allis-Chalmers air-cooled transformers, 440/230 primary; 115/230 secondary.

3—1250 KVA, G.E. transformers, 11,000 Pr. V. with 4 taps on 33,000, 2200 Sec. V., 25 cy. 1 ph. (O.K. for 60 cycle). Ser. 2,297,476-7-8.

PARTIAL LIST—2000 UNITS IN STOCK FROM ONE TO 333 KVA
ALSO AIR COOLED AND SWITCH GEAR

SQUIRREL CAGE—60 CYCLE

HP	Speed	Make
500 (3)	514	West.
450	720	G. E.
400 (2)	514	West.
300	600	West.
250 (2)	3600	G. E.
250	1200	Al. Ch.
250 (6)	900	West.
250 (2)	720	Open
200 (2)	1800	West. TEFC
200 (3)	1800	Wag., Rel.
200	1800	G.E.
200	600	Al. Ch.
150	900	G. E.
150	400	G. E.
125 (5)	1800	Al. Ch.
100 (2)	1800	West.

P.S. We stock 3500 new and rebuilt 1 HP to 100 HP

S. C. & S. R.—25 CY.

Quan.	HP	Speed	Make
1	650	365	S. R.
1	300	375	S. R.
1	300	750	S. C.
1	200	500	S. C.
5	200	500	S. R.
1	200	720	S. R.
1	200	750	S. C.
3	150	500	S. R.
10	135	1500	S. C.

Plus 872 smaller units 1 HP to 125 HP

MOTOR GENERATOR SETS AC-DC

Quan.	KW	Make	Volts
1	1500	G. E.	300
2	1000	G. E.	600
1	1000	G. E.	250
1	1000	West.	250
1	750	Al. Ch.	275
1	600	G. E.	250
1	500	West.	125
1	500	West.	250
2	500	G. E.	250/275
1	500	G. E.	275
1	400	West.	125/250
1	400	West.	500
1	325	G. E.	500
2	300	West.	275

Plus 238 sets from 1 KW to 150 KW in stock.

AC GENERATORS—ALTERNATORS—CONDENSERS

Quan.	KVA	HP	RPM	Cycle
2		2500	720	60
1		1675	600	40
2		1500	900	60
1		1500	1200	60
1		1430	514	60
3		1250	720	60
1		1250	1200	60
1		1000	750	25
2		1000	600	60
1		1000	750	60
1		800	900	60
1		720	900	60
2		650	139	60
1		500	720	60
1		412	225	60
1		400	450	60
3		400	1800	60
1		375	750	25
2		375	1200	60
1		350	720	60
1		312	1200	60
1		300	750	25
1		300	180	60
1		280	1200	60

Plus 78 smaller units from 3 KVA to 250 KVA

DC—ADJ. SPEED—230 V.

Quan.	HP	Make	Speed
1	3600	Dynam.	800/2000
1	650	G. E.	750/2000
1	300	G. E.	400/ 800
1	250	West.	250/ 675
4	250	West.	540/3000
1	125/190	G. E.	260/ 400
1	150	West.	320/ 580
1	150	Rel.	400/1200
1	100/150	West.	500/ 750
2	100	Rel.	575/1150
2	100	West.	450/1000
1	100	G.E.	1050/4000
1	60	El. Dyn.	525/1050
2	30/71	West.	560/ 780
1	50/60	G. E.	220/1000
2	50	Diehl	400/ 800
1	25/50	G. E.	300/1200
1	35	G. E.	250/1000
1	30	West.	500/1000
1	30	West.	700/1750
1	30	Rel. TEFC	400/1200
3	25	G. E.	500/1500

Plus 327 smaller units 1 HP to 25 HP

— M-G LATE ARRIVALS —

2—100 KW Can. W each composed of:
2—500 KW 50/125 V. DC 4000 amp. Generators #48187-8
1—1475 HP 600 rpm 2200/60/3
1—25 KW 125 V. DC Exciter

SLIP RING MOTORS

Quan.	HP	Speed	Make
1	1200	237	Cr. Wh.
1	600	1800	G. E.
1	500	1800	G. E.
1	400	514	G. E.
1	400	435	West.
1	300	500	G. E.
1	300	450	G. E.
2	250	600	G. E.
1	250	480	G. E.
2	200	600	G. E.
3	150	720	G.E.

Plus 837 smaller units 1 HP to 75 HP

ROTARY CONVERTORS

Quan.	KW	Make	Speed	Volts
3	500	G. E.	1200	250
3	400	West.	1200	250
1	300	West.	1200	250

P.S.—We Stock Explosion-Proof Motors—Class 1-D & 2-G

CONSTANT SPEED—230 V.

HP or KW	Make	Speed
500 KW (2)	West. 125/250 V.	900
400 HP	El. Dyn.	1500
400 HP	G. E.	450
360 KW	G.E. 180 V.	1300
300 KW	G. E. 170 V.	1200
250 KW	Al. Ch.	750
150 KW	West. 125/250 V.	750
150 KW	G. E.	1200
150 HP	West.	1615/1785
125 HP	Star	1200
120 KW	G.E.	1250

Plus 675 smaller units 1 HP to 120 HP also 115 V. & 550 V. DC.

Note: We Stock 6000 New Motors, Controls, Frequency Changers
SEND US YOUR INQUIRIES!

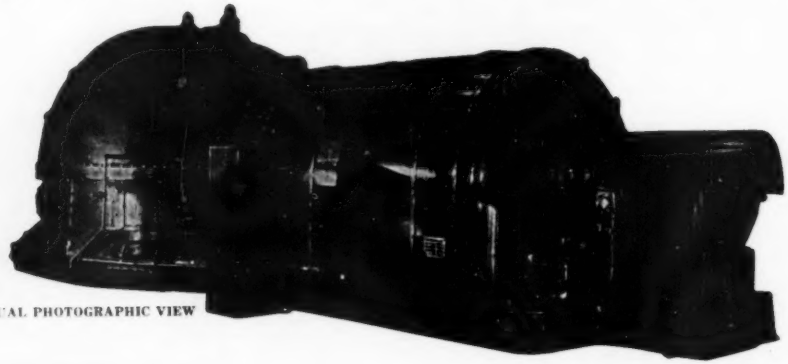
ELECTRIC EQUIPMENT COMPANY

PHONE LD65

New and Rebuilt — ROCHESTER, N. Y. — 1 H. P. to 2500 H. P.

MOTORS — MG SETS — TRANSFORMERS — CONTROLS — COMPRESSORS

25,000 KVA—20,000 KW, 80% P.F., 3 phase 60 cycle, 13,200 volts, 1800 RPM General Electric Company condensing turbine generator unit 215 P.S.I.G. 540-550° T.T. complete with direct connected shaft exciter, switchboard, a 30,000 square foot Westinghouse surface condenser and condensing accessories, including 2—150,000 pounds steam per hour B&W sectional header cross drum boilers, 250# pres., 550° T.T. equipped with Taylor retort stokers.



ACTUAL PHOTOGRAPHIC VIEW

EXCELLENT CONDITION — COMPLETE INSTALLATION — PROMPT DELIVERY

TURBINE-GENERATOR UNITS

Condensing—3 phase, 60 cycle

6250 KVA G.E., 5-stage, 2300/4160 volts, 200# P.S.I., 600° TT.

3750 KVA Westghse. 2300 volt, 200 PSI.

2500 KVA G.E. Type ATB, Form HT, 2300/480 volts, 3600 RPM, 2-bearing alternating current generator LESS TURBINE.

2500 KVA Westghse. 2300 volt, 250 PSI.

1563 KVA Allis, 600 volts, 200 PSI.

1000 KVA G.E., 2300 volt, 250 PSI.

Non-condensing—3 phase, 60 cycle

1563 KVA G.E. 600 volt, 250 PSI, 20# gauge back.

940 KVA Allis 2300/480 volts, 125-150 PSI 12# back.

625 KVA G.E. 2300/480 volts, 125-150 PSI 20# back.

375 KVA Westghse-Moore 480 volts, 250 PSI 5-10# back.

125 KVA G.E., 2300 volts, 150-200 PSI.

125 KVA Westghse. 2400 volts, 150-250 PSI 10# back.

Direct Current

1000 KW G.E., 250 volt, 150 PSI, automatic extraction, condensing.

500 KW (2) Westghse. 3-wire, 250 volt, 285 PSI, condensing.

500 KW G.E., 250 volt, 200 P.S.I., 25# gauge back non-condensing.

300 KW Westghse. 3-wire, 250 volt 150/250# P.S.I. non-condensing.

100 KW (2) G.E., 125 volts, 200-275 PSI.

Direct Current (Cont.)

75 KW (2) Westinghouse-Moore, 120 volt, 200# P.S.I. condensing.

60 KW (2) Elliott, 125 volt, 200-250 P.S.I. non-condensing, exciter sets.

MOTOR GENERATOR SETS

100 KVA Westghse. 60 cycle, 2400 volts, alternator connected 135 HP, 250 volt direct current motor.

62½ KVA G.E., 60 cycle, 2300 volt alternator to 75 HP, 125 volt DC motor.

50 KW G.E. 125 volt direct current 1200 RPM to a 3 phase, 60 cycle, 220 volt syn. motor.

10 KW G.E., 125 volt direct current to a 3 phase, 60 cycle, 220 volt motor.

June BARGAINS SPECIALLY PRICED

5000 KVA Westghse., 4000 volt, 720 RPM Electrical Syn. condenser.

1000 KVA, 60 cycle, 2300/4000 volt, 600 RPM, Westghse. alternator with complete base for direct connection to Diesel engine.

547 HP, 250# pres. and three 400 HP, 225# pres. B&W water tube boilers.

8000 sq. ft. Wheeler, 4400 sq. ft. Worthington, 2000 sq. ft. Worthington and one 1500 sq. ft. Westinghouse surface condensers.

25 HP G.E. 60 cycle, 220 volt, 1170 RPM T.E.F.C. motor.

UNAFLOW GENERATOR UNITS

3 Phase, 60 Cycle

625 KVA G.E. 240 volt generator connected 29"x36" Skinner horizontal engine, 150 PSI complete.

500 KVA G.E. 240 volt generator connected Skinner Vertical engine 150-175 PSI complete.

375 KVA Westghse., 2400/480 volt generator connected Ames Vertical engine, 150 PSI.

175 KVA Westghse., 240 volt generator connected Skinner Horizontal Engine, 125-150# P.S.I., 5# gauge back.

Direct Current

400 KW G.E., 3-wire, 250 volts, 360 RPM generator connected Skinner vertical engine 150 PSI—5# back.

250 KW Crocker Wheeler 125 volt generator direct connected Ames Vertical non-condensing engine 150#.

20 KW Allis 125 volt generator connected Hill vertical Diesel engine.

PUMP UNITS

4900 GPM and 3500 GPM Allis, 2-stage pumps, 130 ft. hd. each connected to 3 phase, 60 cycle motor.

2500 GPM (2), 105 ft. hd. each connected to 100 HP, 3 phase, 60 cycle, 2300 volt Westinghouse motor.

1600 GPM Allis, 210 ft. hd. connected to 3 phase, 60 cycle, 440 volt motor.

1000 GPM (2) 1270 ft. hd., 4 stage Morris pumps each connected 417 HP, 390# PSI G.E. turbine.

UMC UTILITIES MACHINERY CORP.
1965 EAST 6th STREET • CLEVELAND 14, OHIO • Long Distance 422

"THE O'BRIEN STORY"

DISTRIBUTION AND SERVICE . . .

The fact that in whatever corner of the United States you might be, you would be within easy reach of O'Brien distribution and service facilities, confirms the acceptance of O'Brien rebuilt machinery and power plant equipment by thousands of satisfied users all over the nation. With a competent, dependable service organization that is linked from coast to coast, O'Brien can service their machinery throughout the entire United States. This means that you can expect precision performance, economical operation and long life from every completely rebuilt O'Brien machine—each thoroughly reconditioned and tested in O'Brien's own shops and O'Brien guaranteed. We have available now the new, used or guaranteed rebuilt machinery you need to expand, modernize, or re-convert quickly, and with minimum capital expense. Inquire today for prices and delivery!

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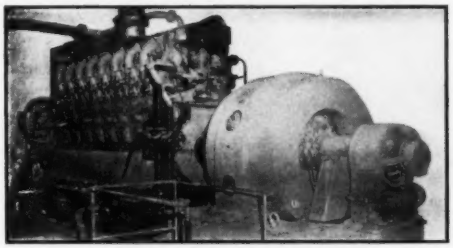
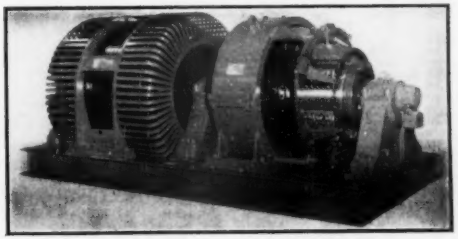


1250 KVA GM DIESEL GENERATOR SET



500 KW WEST. MOTOR GENERATOR SET

MOTOR GENERATOR SETS

1—1500 KW GE MPC 300 V 5000 Amp.—2150 HP ATI-Syn Motor, 3/60/4000 Volt. Available immediately.
1—1000 K.W. West. 250 volt Flat Compound 500 RPM 1440 H.P. West. Syn. Mtr. .8 P.F. 3/25 cycle 2300 V. A.C. & D.C. Panels.
1—660 KW G.E. MPC—2400 amp. 230 volt 514 RPM with 1050 H.P. G.E.—ATI Syn. Motor .8 P.F. 2 ph., 60 cy., 2300 V. A.C. & D.C. Panels. Can furnish 3 ph. 550 V. or 2300 V.
1—500 KW Westinghouse 250 Volt 900 RPM with 720 H.P. West. Syn. Motors 3/60/6600/13200 volt. Serial #313047 (year 1935) See actual photo above.
1—500 K.W. Crocker Wheeler CCD, 250 volt 720 RPM with 750 KVA Cr. Wh. Syn. Motor 3/6/2300 V. A.C. & D.C. Panels.
1—400 KW West. 500 Volt D.C. Any A.C. Voltage with 500 HP West. 350 RPM, 500 Volt Motor for complete drive.
1—360 KW GE CY 125, 180 V., Sep. Exc., 1200 RPM, 500 HP Syn. Mtr., 3/60/2300, 1942.
1—300 K.W. West. 3 wire 125/250 Volt 1200 RPM Generator (1938 year). Can furnish with suitable motor. Advise Requirement.
1—300 K.W. Elliott 250 Volt 1200 RPM with 500 H.P. Syn. Motor 3/60/2300/1200 RPM —Automatic Controller & D.C. Panel.
2—150 K.W. G.E. Type MPC—250 Volt 1200 RPM 3/60/2300/200 H.P. Syn. Motor Drive A.C. & D.C. Panels.
1—100 K.W. Al. Ch., 250 V. 1200 RPM 150 H.P. Syn. Mtr. 2/60 or 3/60 any voltage.
1—100 K.W. G.E.—C.D.—125 Volt D.C. 150 H.P. GE Syn. Mtr., 3/60/220/440/1200 RPM.
1—75 K.W. Burke 250 V., 900 RPM 113 H.P. Burke—Syn. M.D. 2 or 3 ph, any voltage.
2—50 KW GE 500 Volt DC, 75 HP, 3/60/440/1200 RPM.
Smaller Sizes and Types–Advise Requirements

CENTRIFUGAL PUMP

Qu.	GPM	TNH	Descr.	Size	HP	Speed
1	8,000	110'	Worthington	14"	300	1200
1	6,000	110'	Ingersoll-Rand	12"	200	1200
1	4,000	110'	Ingersoll-Rand	12"	200	1200
1	3,500	47'	Southwalk	12"	100	870

CENTRIFUGAL PUMP (Con't)

2	1,700	95'	De Laval	10"	60	1750
1	1,500	231'	Allis-Chalmers	8"	150	1750
1	1,200	40'	Worthington	6"	15	1750

DIESEL & GASOLINE GENERATOR SETS

2—1250 K.V.A. GM 16 Cyl. 3/60/2300 New 1946 Comp. Plant. (See Photo Above)
1—937 K.V.A. GM 12 Cyl. New Engine. Rebuilt Gen. 3/60/480 or 2300.
1—625 K.V.A. Baldwin Series 600—New 1948 —1500 hours. 3/60/2300/514 RPM.
2—438 K.V.A. GM—West. 3/60/2200 860 RPM —New 1937. Complete Plant.
2—375 K.V.A. GM 8-268A, 3/60/480/1200 RPM.
1—300 K.W. GM New 8-268A, 230 DC.
1—250 K.V.A. GM Twin 6-71, 3/60/220/440.
1—125 K.V.A. GM New Twin 4-71, 3/60/220.
1—125 K.V.A. Hercules, 3/60/220/440/1500 Hrs
1—62.5 K.V.A. Cummins 6 Cyl. 3/60/220/440.
1—56 K.V.A. Climax Gasoline. 3/60/220/1200.
2—45 K.V.A. Chry. New 6 Cyl. 3/60/220/440.

ELECTRIC MOTORS

Qu.	HP	Make	Type	Volts	Speed
3	500	West.	CS	6600	514
1	400	G.E.	Syn.	2300	450
1	350	G.E.	MT18	2300	400
1	315	G.E.	Syn.	2200	720
1	200	West.	Syn.	2300	1200
1	150	Ideal	Syn.	220	1200
1	125	West.	Syn. (3 brg.)	550	600
1	125	Cent.	SC	440	1800
2	100	G.E.	Syn.	440	300
1	75	West.	CW	440	1200
1	50	West.	CS	440	3600

TURBO GENERATORS

1—780 KVA G.E.-Moore 3/60/2300/3600 RPM Non-Cond. 180 PSI 35 lb. B.P. New 1936.
1—500 KVA West. Non-Cond. 3/60/220/440. 150 PSI 10 lb. B.P.
2—375 KVA West. Non-Cond. 3/60/440. 125 psi 5 B.P. New 1938

TURBO GENERATORS (Con't)

1—300 KW West. 3 wire 125/250 Volt D.C., Non-Cond. Turbo Unit 125 PSI, 5 lbs. B.P. New 1938
1—75 KW G.E. Non-Cond. D.C. 125 volt.
1—35 KW G.E. Non-Cond. D.C. 125 volt.

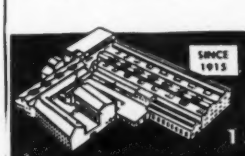
AIR COMPRESSORS

1—12,000 CFM I.R. Turbo 3.25 Lb., direct 250 H.P., 440/3/60/3600.
1—5600 CFM I.R. PRE-2, 42/25½x30, 100 lb. direct 930 HP Syn. 1 P.F. 2300/60/3.
1—4690 CFM I.R. PRE-2 48/24x27 100 lb. direct 804 HP Syn. .8 PF 2300/60/3.
1—3000 CFM GE Turbo 5 lb. direct 90 HP 440/3/60/3600.
2—1400 CFM Sullivan WJ 3 Angle Cpd. 100 psi 22/13x16 belt.
2—1200 CFM I.R. 22/13x16 100 psi belt.
1—900 CFM CP 100 lb. 9CP Portable Diesel Compressor, Pneu. tires.
1—754 CFM Sullivan W-13 13/13x8 60 lb. belt.
1—528 CFM CP NSB 14x12 100 lb.
1—371 CFM Schramm 7¼/5x4 100 lb.
1—368 CFM I.R. ER-1 12x10 100 psi.
1—350 CFM I.R. type 40 7/6¼x5 air cooled 125 lb. direct 75 HP 220/440/60/3 870.
1—396 CFM Sullivan type WL-60 100 psi.
1—215 CFM Penna. 3A 10x8 50 lb.
1—173 CFM CP NSB 9x8 100 lb.
1—173 CFM Penna. 3A 9x8 100 lb.
1—122 CFM Worthington 7x7 Horiz. 100 lb.
2—89 CFM CP 6x7 TB 150 lb.
1—40 CFM I.R. Type 30 80 lb. Tank mtd. 7½ HP
3—21 CFM Curtis CJ-1000, 3 stage 850 lb.
5—16.86 I.R. Type 30, 3½/2x5 400 lb.
100—10 CFM I.R. Type N 26 lb. or 25" Hg. Vac.

BOILERS (ASME)

2—106 H.P., Keeler, Self-contained, 125#
2—250 H.P., Bigelow, Self-contained, 125#
2—360 H.P., Springfield, Cr. Drum, Str. Tube, Sect. Hdr., Water wall 250#
1—390 H.P., Springfield, Cr. Drum, Str. Tube, Sect. Hdr. Water wall, 300#

"Everything from a Pulley to a Powerhouse"



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THE TRADE MARK WITH A MEANING
SUCCESSFUL OPERATION GUARANTEED
44th YEAR OF SERVICE—MEMBER OF A.R.A.*

MOTOR GENERATOR SET
3 ph. 60 Cycle

Qu.	KW	Make	Speed	D.C. Volts	A.C. Volts
1	2000	G.E.	514	600	13800/4000
2	2000*	G.E.	500	600	6600/11000
1	1500	G.E.	720	600	6600/13200
1	1500	Whse.	600	600	2300/4600
1	1500	G.E.	360	275	2200/4400
1	1500	G.E.	600	600	2300/4150
2	1000	Whse.	900	600	2300/4150
1	1000	G.E.	900	260	6600
1	1000(3U)	G.E.	900	250	2400/4800
1	500	Whse.	900	125/250	440
1	500	Whse.	900	250	6600/13200
1	500	Whse.	1200	125/250	2300
1	500	G.E.	720	125	2300/4000
1	400	G.E.	720	250	440/2300
1	400	Whse.	1200	250	2300
1	350	G.E.	900	125	2300/4150
1	300	A.C.	1200	125/250	2300
1	150	G.E.	1200	250	2300
1	150	Whse.	1200	275	2300
1	150	G.E.	1175	125	440
1	140(3U)	Cr. Wh.	680	125/250	2300
1	125	G.E.	1200	125	440
1	100	Delco	1200	125/250	440
1	75	G.E.	1200	125	4000
1	75	G.E.	1200	250	440
1	40	Whse.	1200	250	220

*25 Cycle

ROTARY CONVERTERS
60 Cycles

Qu.	KW	Make	Speed	D.C. Volts	A.C. Volts
1—2000		G.E.	514	600	13800
1—1000		Whse.	900	600	11000

TURBO GENERATORS

Qu.	KW	Make	Desc.
1	6000	Al. Ch.	Condensing 200/250 ISP 2300/3/60-Exc. & Surface Cond.
1	1000	Moore	Auto-Ext. Cond. 175/200# I.S.P. 5/20# G. Ext. Surface Condenser—3/60/2300.
2	1000	G.E.	Non-condensing. 175/200 lbs. I.S.P. 5/20 lbs. G.B.P., 480/3/60.
1	750	G.E.	Condensing 425#-725°TT ISP-440 V. 3 ph. 60 cy New—1944
1	500	Moore	Non-condensing — 150/200 lbs. ISP 5/35 lbs. G.B.P.—3/60/480 volts direct connected exciter
2	500	G.E.	Non-condensing 175/200 lbs. I.S.P., 5/20 G.B.P., 440/3/60.
1	400	Whse.	Non-condensing 125/150# ISP 5/10# G.B.P., 240/480v, 3 ph. 60 cy.
1	300	G.E.	Non-condensing 150/175# ISP 5/15# B.P. 480V. 3 ph. 60 cy.
1	200	Whse.	Non-condensing 150# ISP 7# B.P. 240 V. 3 ph. 60 cy.

400 KW MADE UP MG SET
CAN MAKE UP SIMILAR SET

D. C. MOTORS

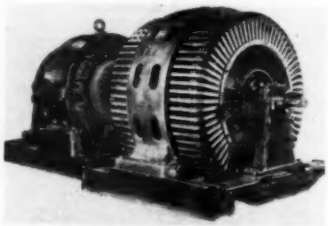
Qu.	HP	Make	Type	Volts	Speed
1—	2200	G.E.	MCF	600	380/500
1—	1750	West.		600	525/720
1—	1500	Whse.		525	600
1—	950	Whse.	QM-R Brg.	250	140/170
1—	800/1000	Whse.		450	600/720
1—	600	Al. Ch.	MILL	230	400/800
1—	500	Whse.	Mill	600	300/900
2—	450	Whse.		550	415
1—	400	G.E.	MCF	550	300/1650
1—	300/400	G.E.	DYNA	250	1325/2500
1—	350	Cr. Wh.	CCM-151H	230	1100
1—	335	Whse.	MQ	250	300/900
1—	200/300	G.E.	MFC	230	300/920
1—	250	G.E.	MFC	230	400/580
1—	150	G.E.		600	250/750
10—	150	Cr. Wh.	83H	220	890
1—	150	Cr. Wh.	CMC-65H	230	1150
1—	150	Whse.	SK-201	230	300/950
1—	50/120	G.E.	MFC	230	250/1000
2—	100	Whse.	SK-181	230	450/1000

FREQUENCY CHANGERS

Qu.	KW	Make	Cycles	Voltage
1—3000		G.E.	25/60	4000/2300x2300/4000
1—2000		G.E.	25/62½	2300/4160
1—2000		Whse.	25/62½	2300/2300
1—1000		G.E.	25/58	4400/2300
1—	500	A.C.	25/60	11000/2300V

SYNCHRONOUS CONDENSERS

Qu.	Kva	Make	Volts	Speed
1	5000	Whse.	2400/4800	600



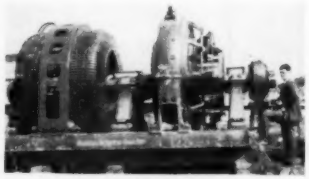
500 KW MG SET
IN STOCK

TRANSFORMERS
60 Cycles

Qu.	KVA	Make	Type	Ph.	Voltages
3	1250	G.E.	BT	3	13200x440/2200
3	1000	G.E.	H	1	2200x480
3	1250	G.E.	H	1	6600x550
1	1150	A.C.	OISC	3	13200x2300/480
1	900	G.E.	HTH	3	2400x240/480
3	500	Al. Ch.	OISC	1	11800x6600
1	500	Whse.	OISC	1	34650x432
1	500	Whse.	OISC	3	13400x216
9	300	G.E.	HT	3	2400x240/480
3	200	Wagner	OISC	1	13800x230/460
3	150	Whse.	OISC	1	33000x2300/4000
3	150	Whse.	OISC	1	34500x230/460
3	100	G.E.	OISC	1	2400x120/240
2	75	Upto	oISC	3	4160x210

RECTIFIERS

Qu.	KW	Make	Type	Volts	Speed
1—	750	G.E.	BHW	575	2300
1—1000		A.C.	B-612	625	13500



2000 KW—MG SET
IN STOCK

A. C. MOTORS
3 ph. 60 Cycle
SYNCHRONOUS

HP	Make	Type	Volts	Speed
2—3500	G.E.	TS	2300	257
1—2500	Whse.		2300	720
2—2100	G.E.	ATI	2300	360
2—2000	Whse.		2300	120
2—1750	G.E.	ATI	2300	3600
3— 735	G.E.	ATI	2200/12000	600
1— 500	G.E.	TS 7657	2400/4800	600
1— 450	Whse.	Eng.	2200	128.5
1— 450	Whse.		2300	450
2— 350	G.E.	TS	2200	150
1— 300	Whse.		2300	720
1— 100	Whse.		550	600
1— 100	F.M.		220	1200
1— 100	E.M.		440	600
1— 85	G.E.	TS	440	1800

SLIP RING

1— 500	Whse.	CW	550	350
2— 500	G.E. unused	M-574Y	2200	900
1— 500	G.E.	IP	550	505
1— 500	G.E.	IM	440	900
1— 350	G.E.	MT442-Y	2200/4000	253
1— 300	Al. Ch.	3 Brg.	2300	505
4— 300	G.E.	ITC-5017	550	585
1— 300	Al. Chal.	ANY	2200	708
1— 250	G.E.	MT-424Y	4000	257
1— 250	G.E.	MT-559S	2300	1750
1— 250	A.C.		550	600
1— 200	Cr. Wh.	26QB	440	505
1— 200	G.E.	IM	440	435
1— 200	G.E.	MTP	440	1170
3— 200	G.E.	IM-17	440	580
1— 150	new Whse.	CW	2300	450
4— 125	G.E.	MT-566Y	440/2200	435
1— 100	G.E.	IM-16	2200	435
1— 100	G.E.	IM	440	600
3— 100	Al. Ch.	ANY	440	695
1— 100	G.E.	MT556	2200	900
1— 75	Whse.	CW-761	2200	1725

SQUIRREL CAGE

2— 650	G.E.	FT559BY	440	3750
2— 450	Whse.	CS	2300/4150	354
1— 200	G.E.	KT-574Y	2300	505
1— 200	G.E.	IK-17	440	580
1— 200	G.E.	KT557	440	1800
1— 200	G.E.	IK	440	865
1— 150	Whse.	CS	440	580
1— 150	Wstghse.	CS8568	440	830
1— 125	Whse.	MS	440	485
1— 125	G.E.	KF-TEFC	440	3585
2— 125	Al. Ch.	ARW	2200	1750
1— 100	G.E.	IK-Vert.	2300	450
1— 100	G.E.	KT-513	220/440	1750

*American Rebuilders Association — Member Body of A.S.A.

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GUARANTEED "REBUILTS" GIVE A-1 PERFORMANCE

SQUIRREL CAGE MOTORS

3 Phase, 60 Cycle, 220 or 440 Volts (*2200 Volts or higher)

H.P.	Make	Type	Speed
1000	*G.E. (New)	K6347S	1800
750	*A. C.		1800
750	*G. E.	KT	720
700	*G. E.	FT	3600
700	*Westgh.	CS39D	1800
450	*G. E.	KF567S	1200
400	*Westgh.	CS	1800
400	*Cont. (New)	NZ	1200
400	A. C. (New)	ANW	900
400	*G. E.	IK	514
350	*Cr. Wh.	SC	3600
300	*Westgh.	CS	3600
300	G. E.	IE-K	1200
300	A. C.	AR	900
250	*Westgh.	CS875S	1800
250	A. C.	630DSWW	1200
250	*L. Allis	OGX148S	720
250	G. E.	IK	600
200	*G. E.	FT549Y	3600
200	*G. E.	IK13B	1800
200	Westgh.	CS	720
200	*A. C.		720
200	G. E.	IK17	600
200	A. C.	ARWWT	600
150	*G. E.	FT539Y	3600
150	G. E.	KT546	1800
150	*A. C.	AN	1800
150	G. E.	IE-K	1800
150	*G. E.	IK	600
150	*Westgh.	CS	450
125	Westgh.	CS504S	3600
125	*A. C.	AR226	1800
125	Westgh.	CS	1200
100	*G. E.	FT542Z	1800
100	G. E.	FTRP	1800
100	*Westgh.	CS	1800
100	Rel. (New)	AA5085 (TEFC)	1200
100	A. C. (New)	AW	1200
100	*A. C.	AR	1200
100	G. E.	IK15A	1200
100	U. S.	SCV (Vert.)	1200
100	*Westgh.	CS (Vert.)	1200
100	A. C.	AN	900
100	G. E.	1K15A	514

Hundreds of Smaller Motors.

D. C. MOTORS

Mill Type—Pedestal Bearing—Reversing

H.P.	Make	Volts	Speed
3000	West. (Tandem)	525	600
1750	West.	600	550
1500	West.	525	600
1200	West.	525	600
1000	West.	450	600

230 Volts — Constant Speed

H.P.	Make	Type	Speed
375	Westgh.	Ped	650
200	Westgh.	SK210	800
175	G. E.	ELC11	750
125	G. E.	Marine	1200
100	G. E.	RC34	2500
100	Westgh.	SK173	850
100	A. C.	E182	575
75	G. E.	MDS106	485
50	G. E.	RC35	700
50	G. E.	DLC204	650
40	Cr.-Wh.	CMC	1800
40	G. E.	RC32	1200
40	A. C.		750
40	G. E.	CO2004	500
35	Cr.-Wh.	CM351	700
30	Westgh.	SK93	1750
30	Westgh.	SK120	975
30	G. E.	MD104½	725
30	Cr.-Wh.	CCM	450
30	G. E.	C-60	240
25	G. E.	CD93	1150
25	Westgh.	SK100L	1100

MANY OTHERS—1 HP and UP!

A VIEW OF REBUILDING OPERATION

CHICAGO ELECTRIC EXPERTS DO PRECISION REBUILDING

Craftsmanship is a vital part of Chicago Electric rebuilding. Each workman's pride in his ability . . . each workman's personal satisfaction in doing a good job has enabled Chicago Electric to continually guarantee their service and their rebuilt equipment. The next time you need electrical power equipment call Chicago Electric.

SLIP RING MOTORS

3 Phase, 60 Cycle, 220 or 440 Volts (*2200 Volts or higher)

H.P.	Make	Type	Speed
2500	*G. E.	MT	257
600	*Cr.-Wh.	131AQ	507
500	Westgh.	CW	350
400	*A. C.	ANY	505
400	A. C.	3-brg.	450
400	*G. E.	MT412	450
300	*G. E.	IM15	1800
300	G. E.	IM	900
300	G. E.	MT	600
300	Westgh.	CW	600
300	*G. E.	MT410	450
250	*G. E.	IM	900
250	G. E.	IM	720
250	Westgh.	HF15H	600
250	*G. E.	IM17A	514
200	G. E.	IM	1800
200	G. E.	IM15	1200
200	G. E.	IM	720
200	Westgh.	CW	600
200	G. E.	IM	600
150	Westgh.	CW772G	1200
150	*Westgh.	CW870C	900
150	*G. E.	IM16	600
125	*G. E.	MT549	1800
125	*G. E.	MT557Y	1200
125	G. E.	IM17A	600
100	A. C.	ANY	900
100	G. E.	IM15A	450

ENGINE-GENERATOR SETS

KVA	Make	Type	Volts	RPM
300	G.M.	8-268A	480	1200
100	G.M.	6-71RC	480	1200
31	Cum.-Rog	H-1-6	120/208	1200
25	LeRoi	20-A	120	900
10	Onan	PE25G	115/230	1800
1½KW	Kohler	D-7551	110 DC	1000
1	Onan	10L-163	115	

MILL DRIVES

PAPER—STEEL

Variable Speed Packaged Units

HP	Make	Speed
150	Gen. Elec.	75/1075
100	Allis-Chalmers	75/1170
75	Westinghouse	75/1275
50	Gen. Elec.	75/1050
40	Gen. Elec.	100/1800
30	Gen. Elec.	100/1800

PARTIAL LIST ONLY — Send your inquiries—We can quote.

AC SYNCHRONOUS MOTORS

3 Phase, 60 Cycle, 220 or 440 Volts (*2200 Volts or higher)

H.P.	Make	Type	R.F.	Spd.
1420	*Westgh.	Syn.	0.7	900
1400	*G. E.	ATI	0.35	720
800	G. E.	TS984	1.0	1800
720	*A. C.	Syn.	0.8	900
700	*G.E. (New)	TS975Z	1.0	1200
700	*Westgh.	Syn.	1.0	225
600	*G. E.	ATI	1.0	240
600	*G. E.	TS7640	1.0	900
360	G. E.	ATI	1.0	1200
320	*A. C.	Syn.	1.0	720
300	G. E.	ATI	0.8	900
300	*G. E.	ATI	1.0	720
300	*Ideal	SMM	0.8	257
250	*A. C.	Syn.	0.8	720
150	*Westgh.	HR	1.0	300
125	Parkinson	Syn.	0.9	900
125	*El. Ma.	Syn.	1.0	900
125	Cr.-Wh.	103S	1.0	900
125	*G. E.	TS	1.0	277
115	El. Ma.	EM	1.0	240
100	Cr.-Wh.	103S	0.8	900
100	*G. E.	ATB	0.8	900
100	Ideal	SNS	1.0	900
75	G. E.	ATI	1.0	300
40	G. E.	ATB	0.8	1200
20	Fynn-W.	15VRN		1200
15	Ideal	Syn.	0.9	1800
15	Century (208v.)	ARC365	1.0	1200
7½	Ideal	Syn.	0.9	1800

AC SYNCHRONOUS GENERATORS

3 Phase, 60 Cycle, 220 or 440 Volts (*2200 Volts or higher)

KVA	Make	Type	P.F.	Spd.
3500	*G. E.	ATI	0.8	720
1750	*Westgh.		0.7	900
1500	G. E.	ATI	0.8	720
700	*A. C.		0.8	900
300	G. E.	ATI	0.8	720
250	*A. C.		0.8	720
112½	*G. E.	ATB	0.8	1200
110	Cr.-Wh.	103	0.8	900
100	*G. E.	ATB	0.8	900
60	F-M	B	0.8	900
55	G. E.	ATB	0.8	1200
50	G. E.	ATB	0.8	1200

CHANDEYSSON ANODIZER
NEW 1000 Amp. 40 volt, type NPT, d/c to 60 HP A-28 Syn. Motor, 3/60/220, 600 RPM, 25° C. continuous.

SPECIAL OFFERING ROTARY CONVERTERS!!

1000 KW	Westinghouse Rotary Converter Input: 450 v. AC, 60 cy., 6 ph., 900 RPM Output: 600 v. DC, 1670 amps. Complete AC and DC Controls 1000 KVA OIWC Transformer, 4150/416 volts
500 KW	General Electric Converter, Type HCC-P Input: 445 v. AC, 60 cy., 6 ph., 900 RPM Output: 600 v. DC, 834 amps. Complete AC and DC Controls 500 KVA OISC Transformer, 13200/445 V.

M. G. SETS

K.W.	Make	A.C.	D.C.
2400	A-C (3-unit)	4800/2400	525
2400	West. (3-unit)	4800/2400	600
1000	G.E. (3-unit)	11000	137½/275
1000	West.(3-unit)	11000	137½/275
1000	G. E.	2300	600
1000	G. E.	4000	250
750	A.C.	440	250
500	Al. Ch.	2300	250
500	Cr.-Wh.	220/440	250
450	G. E. (3-unit)	2300	125/250
250	West.-G. E.	440	250
200	Ridgeway	2200	250
150	G. E.	2300/440	250
150	G. E.	440	250/275
100	G. E. (25 cy)	440	125
100	G. E.	2300	250
100	G. E. Delco	440	120/240
75	Al. Ch.	440	250
60	Al. Ch.	2300	110
40	Cr.-Wh.	220	125
35	G. E.	440	125
25	Westgh.	2200	125
20	G. E.-Bogue	440	125
20	G. E.-Bogue	550	250
20	G. E.	440	250
15	G. E.	220	250
10	G. E.	440	125

TRANSFORMERS

KVA	Make	Ph.	Prim.	Sec.
2000	Pittsb.	1	12000	2300
1000	Westgh.	3	4800	480
850	Westgh.	3	4160	455
500	G. E.	3	13200	445
300	G. E.	3	13800	240/480
300	G. E.	3	2400	240/480
200	Westgh. (Air)	3	2400	455
167	A. C.	1	2400	240/480
100	G. E.	1	6900/11950	240/840
100	A. C.	1	7200	120/240
100	A. C.	1	2400	240/480
75	A. C.	1	7200	120/240
100	Al. Ch.	1	2400	120/240
75	Al. Ch.	1	2400	120/240

SMALLER RATINGS 2400 to 120/240

PHONE: CANAL 6-2900

CHICAGO Electric Co.

1320 WEST CERMAK ROAD, CHICAGO 8, ILL.

The BOSTON METALS Co. *offers* BOILERS, MILL MOTORS & TURBO-GENERATORS *at Bargain Prices*

2 MODERN PACKAGE TURBO-GENERATOR SETS

with self contained condensers

1350 K.V.A.—BUILT 1943

TURBINES: Westinghouse, Serial No. 2-A-9593-99 & 2A-9593-100. Impulse reaction type—7 stages condensing—3500 H.P.—4800 R.P.M. Steam pressure 440 P.S.I.—Exhaust pressure 27½" vacuum. Temp. 740°—weight 13000 lbs.

GENERATORS: Westinghouse, Serial No. 109S20P900 & 108S20P900—3 phase two pole type—2550 K.V.A.—82½ cycles—2210 volts—100% P.F.

THESE GENERATORS CAN BE RE-WOUND FOR APPROX. 1350 K.V.A.—3 PHASE—60 CYCLE 2300 OR 440 VOLT OPERATION WITH TURBINE SPEED REDUCED TO 3600 R.P.M.

CONDENSERS: Westinghouse—2 pass—2200 Sq. ft.—vacuum 27½"—¾" tubes 12 ft. long—weight, 26,700 lbs. Condensers mounted below turbine. Oil Pump & oil cooler mounted directly on unit. Unit completely mounted on pre-fab sub-base.

THESE UNITS CAN BE DELIVERED RE-WOUND IN A VERY SHORT TIME.

6 B&W BOILERS

cross drum sectional header

BUILT 1943 — IMMEDIATE DELIVERY

Heating Surface	11417 sq. Ft.
Design Pressure	200 P.S.I.G.
Working Pressure	200 P.S.I.G.
Capacity	75,000 lbs./hour
Steam Temperature	Saturated
Furnace Volume	1024 Sq. Ft.
Feed Temperature	200°
Oil Burners	8 per boiler

BOILER DIMENSIONS
19' 4" wide, 16' 4½" high, 15' deep

BOILER TUBES
1667—1¼" straight, 12' 2" long
825—1¼" bent; 122—2" straight
(first 2 rows above fire box)
Downcomer & Uptake Tubes
4" & 4½" bent

WATER WALL SIDES IN FURNACE

HYDROSTATICALLY TESTED NOV. 1951 BY PRUDENTIAL LIFE INSURANCE CO.

3 MODERN TURBO-GENERATOR SETS

250 K.W.
440/3/60
1200 R.P.M.

TURBINES: Worthington-Moore, 440 lbs. W.P., 740° T.T., Serial No. 7454—7452—7432, type S4—5 stage condensing—28.5" Vac.—turbine speed 6097—gear speed 1200. Westinghouse-Moore reduct. gear 6097/1200.

GENERATORS: Westinghouse, 312 K.V.A.—250 K.W.—3/60/440 1200 r.p.m.—400 amps.—80% P.F.—125 volts d.c. excitation—exciters direct connected 5.5 K.W.

UNIT IS MOUNTED ON PRE-FAB SUB-BASE. BUILT-IN OIL COOLERS. THESE ARE MODERN UNITS RECENTLY REMOVED FROM A NAVAL VESSEL.

16 MILL MOTORS—*Complete With All Controls*

50 H.P. — 230 VOLTS D.C. — 600 R.P.M.

The BOSTON METALS Co.

313 E. Baltimore Street — Baltimore 2, Md.

Phone Curtis 5050

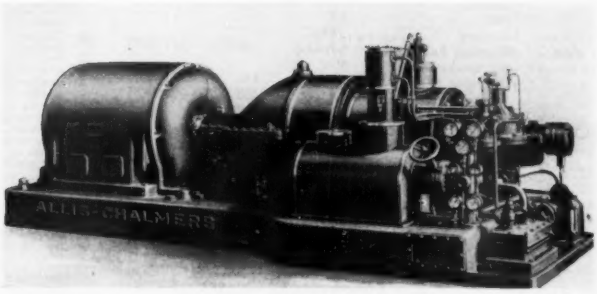
All items can be seen at the Boston Metals Co. Marine Warehouse, Curtis Bay, Baltimore

CHARLES WEAVER

Specialists in

TURBINE-GENERATORS, BOILERS and GENERAL POWER PLANT MACHINERY

OUR PRESENT STOCK -30- Turbine Sets, IS ONE OF THE LARGEST IN THE UNITED STATES



CONDENSING TURBO-GENERATORS IN OUR STOCK

1— 500 KW, Allis Chalmers, 150/200 psig, 3/60/480 Volt
2— 500 KW, General Electric, 150/200 psig, 3/60/480 Volt
3— 600 KW, General Electric, 160/200 psig, 3/60/2300 Volt
4— 625 KW, Allis Chalmers, 140/200 psig, 3/60/480 Volt
5— 750 KW, Allis Chalmers, 150/200 psig, 3/60/480 Volt
6— 750 KW, Allis Chalmers, 160/200 psig, 3/60/480 Volt
7— 750 KW, Allis Chalmers, 150/200 psig, 3/60/480 Volt
8— 750 KW, Westinghouse, 140/200 psig, 3/60/2400 Volt
9— 750 KW, West. Aut. Extr. 175/200 psig, 3/60/2400 Volt
10— 750 KW, Elliott, 150/200 psig, 3/60/480 Volt
11— 750 KW, Allis-Chalmers, 150/200 psig, 3/60/2300 Volt
12— 750 KW, General Electric, 150/200 psig, 3/60/480 Volt
13—1000 KW, General Electric, 175/250 psig, 3/60/2300 Volt
14—1000 KW, Westinghouse, 220/450 psig, 750°TT, 2400/4160 V
15—1000 KW, Allis-Chalmers, 125/200 psig, 3/60/2300 Volt
16—1000 KW, General Electric, 175/200 psig, 3/60/2300 Volt
17—1000 KW, Allis-Chalmers, 140/200 psig, 150° FTT, 3/60/2300
18—1000 KW, Allis-Chalmers, 150/200 psig, 3/60/440 Volt
19—1500 KW, Allis-Chalmers, 150/200 psig, 3/60/2300 Volt
20—2000 KW, General Electric, 175/200 psig, 3/60/2300 Volt
21—2500 KW, General Electric, 150/250 psig, 3/60/2300-4160 V
22—2500 KW, General Electric, 150/200 psig, 3/60/2300 Volt
23—3000 KW, General Electric, 150/250 psig, 3/60/480 Volt
24—5000 KW, General Electric, 150/200 psig, 3/60/2300-4160 V

NON-CONDENSING TURBINES IN OUR STOCK

25—2500 KW, General Electric, 150/175 psig, 10/15-BP., 2300 V
26—2000 KW, Westinghouse, 250/350 psig, 25/40-BP., 2300 V
27—1250 KW, General Electric, 125/150 psig, 12/15-BP., 480 V
28—1000 KW, General Electric, 150/175 psig, 15/25-BP., 2300 V
29—1000 KW, Westinghouse, 150/175 psig, 15/25-BP., 480 V
30-31—500 KW, General Electric & West., 115/150 psig, 15/25-BP., 480 V
32-33—500 KW, Allis-Chalmers, 110/140 psig, 15/25-BP., 480 V

ALL MACHINES ARE 3600-RPM. NEARLY ALL CAN BE RECONNECTED.

BOILERS, ETC.: Please Send Us Your Specs. CORRESPONDENCE INVITED.

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GOOD EQUIPMENT • RIGHT PRICES • QUICK DELIVERIES

LIQUIDATION SALE

AT 270 23RD STREET, BROOKLYN, NEW YORK SOUTH 8-4902

DIESEL ENGINES

	HP	MAKE	MODEL	RPM	CYCLE
3—	1600	General Motors	16-258S (marine)	900	4
2—	500	GMC Winton	204-8 (marine)	1000	4
1—	285	Chicago Pneumatic	RH-75-D	300	4
2—	200	GMC Winton	6-138 (marine)	700	4
8—	150	Superior	SMRA-4 (marine)	2400	4
2—	150	GMC Winton	6-179 (marine)	800	4
5—	69	Hercules	DJXC	2600	4

Also: Fairbanks-Morse, AEC and Junkers

DIESEL GENERATOR SETS

DC, 120V	1—	60 KW	Superior model	GA-8		
	2—	20	Hill	4R		
	1—	20	Hill	4R		
	2—	15	Hercules	DOOD		
	1—	11	Petters			
	6—	10	Hill	2-R		
	1—	4	Junkers	1HK65		
AC	1—	210 KVA	Chicago Pneumatic	4-H-40-S	240V	327 RPM
	1—	37½	Fairbanks-Morse	V		
	1—	31.3	Chrysler	IND-3	440	1200
	1—	32.5	Fairbanks-Morse	32	2400	300

AC MOTORS — 3 PHASE, 60 CYCLE

	HP	V	RPM	MAKE
1—	150	440	690	Westinghouse (slip ring)
1—	75	220/440	690	Westinghouse (slip ring)
1—	75	440	565	General Electric (slip ring)
1—	60	220	870	Westinghouse (slip ring)
1—	40	220	1200	General Electric
15—	2¾	440	3500	Electro Dynamic
65—	½	220	1725 (2 phase)	Western Electric

GENERATORS—DC AND AC

From 10-1500 KW

MOTOR-GENERATOR SETS, DC, 230 V to 3/60/120

3—25 KVA, Continental
3—25 KVA, Burke Electric Company

GASOLINE ENGINE-GENERATOR SETS

1—34 KW Buffalo Gasoline engine, type R, 900 RPM, with Western Electric 5-G-101 generator, 230 volts.
Also large number from ¾ KW to 5 KW.

GASOLINE ENGINES

2—Sterling "Admiral" (marine), 800 HP @ 2200 RPM
8—Hall Scott "Defender" (marine), 680 HP @ 2100 RPM
8—Wright-Hispano Suiza, 360 HP @ 1750 RPM
6—Waukesha, 42 HP @ 2200 RPM
Also large number from 1 HP to 25 HP

NEW STEAM TURBINES

20—General Electric, 1000 HP, 525± temp, 825° F, with Falk reduction gear, pinion RPM 5405, gear RPM 3060, complete with throttle valves and other parts.

NEW DIESEL ENGINE PARTS

98—Fuel oil filter assemblies for General Motors 6-71 twins
9—Kits, spare parts for Buda 6-DTG-468 diesel large Stock
1—Alco Model 540

AIR COMPRESSORS—DIESEL DRIVEN, GASOLINE DRIVEN, ELECTRIC DRIVEN

From 64 CFM to 500 CFM, Ingersoll Rand, Schramm, Gardner-Denver, Sullivan, Chicago Pneumatic, etc.

CENTRIFUGAL PUMPS

From 1000 GPM to 6000 GPM, 100/300 feet.
Also motor driven pumps

LUBRICATING PUMPS

2—Burke Electric Company, horizontal, 55 HP, 115 V. DC.

BLOWERS

12—Ilg Company centrifugal electric-driven ventilating blowers, from 5,460 CFM to 23,250 CFM capacity, with 3/60/440 motors
3—Buffalo Forge Company hull ventilating blowers, 8000 CFM, with GE motor, 6 HP @ 1735 RPM
Also axial flow fans

MARINE REDUCTION GEARS

9—Twin disc assembly, duplex, manufactured by Link Belt Engr. Co., 950 HP @ 2400 RPM, input shafts, output speed 596.4 RPM.

FREQUENCY CHANGER

1—20 KW frequency changer, General Electric KT-512Y motor, 25 HP, 3/60/220, output motor 3/180/220.

WELDING MACHINES

8—300 amp. gasoline driven
1—1000 amps. diesel driven
Motor driven welders, transformer type, Spot-welder

HICYCLE TOOLS—3/180/220

(Motor generator set available)

700—drills, nut runners, screwdrivers, impact wrenches

ICE PLANTS

7—One-ton portable York ice plants, model Y-50, with Continental 4-cylinder gasoline engine.
1—Fifteen-ton York ammonia compressor
REFRIGERATION UNITS

HOISTS AND WINCHES

1—Lambert double drum steam hoist, 10"x12" cylinders
1—Clyde double drum gasoline-driven scraper hoist
1—Page double drum hoist, diesel-driven, 16"x 17", with Page 150 HP, 350 RPM engine.
1—LST stowing winch with 15 H.P. motor.
ELECTRIC HOISTS

CRANES

1—Tournacrane, model TC-30, 30 ft. boom and jib.
1—Tournapull, model Super C, with Caterpiller D468 diesel engine, 98 HP, 6 cylinder
1—Cranemaster, tractor type, 5 tons, 18 ft. non-revolving boom.
13—5-ton gasoline stevedore cranes, with 18' non-revolving booms.
3—Shepard-Niles 6 ton overhead cranes, 2-motor, 28' 8¼" span, equipped as ice cranes with 4 hooks.
1—Bucyrus-Erie model B2 pile-driving crane, 50' boom, steam operated.
1—Bucyrus-Erie model B2 pile-driving crane, steam operated.
1—Vulcan Number 2 pile driving hammer.
1—Union Number 6 pile driving hammer.
Also Truck Cranes

TRACTORS

1—Caterpiller model D-50 diesel power tractor, crawler mounted, with LaPlante-Choate straight blade bulldozer.

WAGON DRILLS

2—Cleveland model D-14 wagon dril's
1—Ingersoll-Rand wagon drill, type AIN-75

CONCRETE MIXERS

1—Jaeger 14-S, portable
1—Koehring 21-S
1—Rex 10-S
2—Ransome 7-S

20,000 Light Bulbs
1000 Watts 220-250 Volts

Concrete-Brickmaking Machines
Radiator Core Soldering Furnace
Vertical Plate Bending Roll, capacity 1½"x14'
Niles Heavy Duty Plate Shear—16" knife, 36" gap
Niles Bement plate planer, 20", 2 cutting heads
Milling machines
Forging hammers
Underwater velocity tools
Gasoline locomotives
Road Rollers—6 ton
Heat Exchangers
DC Turbo-generators
Transformers
Light Plant
Fork & Platform lift trucks
Degreasing machines
Flexible shaft grinders
Riveters
Sanding Discs
Hydraulic Jacks
Viscolizer pump
Pulverizers
Dessicite
2" Marine rubber bearings
6" Suction and refueling hose
Feed rolls, 1000 amps. 3 conductor
Wire Rope
Wire Rope Slings

EASTERN SCRAP & SALVAGE CORPORATION

65 MUIRHEID AVENUE, TRENTON 7, NEW JERSEY **TELEPHONE 5-6349**

MOTORS—M. G. SETS—TRANSFORMERS

ENGINEERED AND REBUILT BY EXPERTS IN OUR OWN PLANT

SQUIRREL CAGE MOTORS

3-Ph., 60-Cy.

Qu	HP	Make	Type	Volts	RPM
1	400	Cont.	NZ-806	2300	1200
1	400	G.E.	IK	2200	514
1	400	G.E.	KT-412	2200	435
2	300	Whse.	CS-898	2300	1780
1	200	Whse.	CS-873C	2200	1160
1	200	Al.Ch.	AR	440/220	580
2	125	Al.Ch.	AR	2200	1750
1	125	Whse.	CS-761C	440/220	1750
1	125	C.W.	126-Q	440/220	430
2	100	Whse.	CS-663C	440/220	1750
1	100	Al.Ch.	AR	550	690
1	100	F.M.	H241B	440/220	435
1	100	Whse.	CS-938	2200	495
1	78	G.E.	I-K15	440/220	570
1	75	Al.Ch.	AR	2200	1765
1	75	Al.Ch.	AR	2200	1750
1	75	Al.Ch.	AR	2200	690

SYNCHRONOUS MOTORS

3-ph., 60-Cy.

Qu	HP	Make	PF	Volts	RPM
1	6000	G.E.	100	2300	90
1	3000	Whse.	80	4800/2400	720
2	2100	G.E.	100	2300	360
2	1750	G.E.	100	2300	3600
1	1000	El.Mchy.	100	440	1200
1	750	G.E.	80	2300	450
1	250	G.E.	80	2300	514
1	250	El.Mchy.	80	440	400
1	187	G.E.	80	220/440	720
1	150	G.E.	100	2200	900
1	150	G.E.	100	550	600
1	150	G.E.	80	550	450
3	135	G.E.	80	4000/2200	1200
3	125	El.Mchy.	100	4800/2400	900
1	125	G.E.	80	2200	900
2	100	Whse.	80	440	1800
1	100	Ideal	80	220/440	900
2	100	G.E.	80	220/440	600

SLIP RING MOTORS—CONSTANT DUTY

3-Ph., 60-Cy.

Qu	HP	Make	Type	Volts	RPM
1**	1800	G.E.	MT-498	2300	352
1**	1200	G.E.	MT-26	2200	275
2**	1000	Al.Ch.	ANY	2200	255
1**	600	G.E.	MT-20	2300	360
2	500	G.E.	I-16-M	2300	450
1	400	Al.Ch.	ANY	2200	514
2	400	G.E.	MT-412	2200	450
1	300	Al.Ch.	ANY	2200	514
1	250	Al.Ch.	ANY	440	720
1	250	G.E.	MT-414	2200	300
1	200	G.E.	I-16-M	2200	600
1	150	G.E.	I-13-M	2200	1750
1	125	Whse.	CW-870	2200	900
1	100	F.M.	H20C	440	900
2	100	G.E.	I-15-M	2300	514
1	75	Whse.	CW-7340	440	720
1	60	Whse.	C.W.	440	900
1	50	G.E.	MT-536	2200	1200

With the above we can supply manual or full magnetic control, standard or reversing, also with dynamic braking if required.

D.C. GENERATORS

Qu	KW	Make	Volts	RPM	Type
4	800	Al.Ch.	525	750	Marine
2	250	Whse.	120/240	1200	1-Brg.
1	155	G.E.	250	720	MPC
1	100	Delco	120/240	1200	1-Brg.
1	85	Cr.Wh.	250	1050	CCD

MOTOR GENERATOR SETS

Qu	KW	Make	RPM	Volts DC	Volts AC
1	2400(3-U)	Al.Ch.	720	525	4800/2400
1	2400(3-U)	Whse.	720	600	4800/2400
1	1000	G.E.	514	550	2300
1	1000(3-U)	Whse.	900	250/125	4160/2300
1	500	C.W.	720	250/275	2300/440
2	500	C.W.	720	575	2300/440
1	500(3-U)	Whse.	1200	250	440
1	250	Whse.	1200	125/250	2300
1	200	Whse.	1200	125/250	2300/440
1	200	Ridgway	900	275	2200
1	155	G.E.	720	250	2300/440
1	150	G.E.	1200	500	2300/440
1	100	Al.Ch.	2000	125/250	4000/2300
1	100	C.W.	1200	125	440/220
1	100	Delco	1200	125/250	440/220
1	100	Ridgway	1200	275	4000/2300
1	85	C.W.	1200	250	4000/2300
1	75	Star	1200	230	440/220
1	75	Al.Ch.	900	250	2300
1	75	Whse.	900	75	2200
1	50	Burke	1750	250	440/220
1	35	Whse.	1750	250	440/220
1	25	Ideal	1750	125	220
3	20	Al.Ch.	1200	250	440/220
1	15	Al.Ch.	1200	250	440/220
1	9	Whse.	1200	125	440/220
1	5	Reliance	1750	250	440/220

We can furnish any of the above sets with exciters and VARIABLE VOLTAGE CONTROL engineered and rebuilt for your requirements.

JUST PURCHASED
STILL ON THEIR FOUNDATIONS
IN OAKLAND, CALIFORNIA

(3)—Westinghouse and (4) G.E. 1000 KW Motor Generator Sets. Generators 600-VDC compound, interpole, 514 RPM, direct connected to 1440-HP syn. motors, 11,000 Volt, 3 phase, 60 cyc'e (will reconnect for 6600-Volt), each set complete with DC panels and reduced voltage starting panels.
Priced right before removal.

DIRECT CURRENT MOTORS

Qu	HP	Make	Type	RPM
1***	3000	Whse.	Encl.(Rev.)	600
1***	2400	Whse.	Encl.(Rev.)	600
4***	1500	Whse.	Encl.(Rev.)	600
4***	1200	Whse.	Encl.(Rev.)	600
4***	800	Whse.	Encl.(Rev.)	600
1	350	G.E.	CD-169-A	1150

Below: McCabe's Philadelphia Plant.

DIRECT CURRENT MOTORS—Cont.

Qu	HP	Make	Type	RPM
1	300	Whse.		240/300
1	200/250	El.Dy.	No. 22	400/1200
1	250	G.E.	MPC	325/975
1***	200	G.E.	MPC	500/1200
1	200	Whse.	Mill	300/1200
1	180	G.E.	MPC	400
1*	150	C.W.	SS-H	890
1***	125	Whse.	SK-190	600
2	125	Whse.	SK-184	575/850
1	90/160	G.E.	MPC	625/1125
1	50	Whse.	SK	500/1500
1	50	Whse.	SK	250/1000
1	40	Whse	SK-140	500/1700
1	35	G.E.	RF-14	500/1500
1	35	G.E.	CD-125	400/1200
1	35	G.E.	CD-147	300/1200
1	35	Rel.	35P	250/1000
1	32½	Whse.	SK-150	400/1200
1*	30/75	Whse.	SK-151L	400/1200
1	30	Al.Ch.	E-145	400/1200
1	30	G.E.	CDM-105	875/1750
2	27½	El.Dy.	158	450/1350
1	25	Whse.	SK-123	500/1500
1	25	G.E.	RF-13	400/1600
1	25	G.E.	CD-123	400/1200
1	25	Whse.	SK-140	400/1200
1	25	Whse.	SK-111L	250/1000
2	20	Al.Ch.	E-130	400/1200
3	20	G.E.	CD-123	300/1200

All above 230-VDC except where marked ***.
*** Pedestal bearing mill design 525/600-VDC.
Rev.—designed for mill reversing service.
*—T.E.F.C.

TRANSFORMERS (POWER)

Qu	KVA	Make	Type	Phase	Voltage
1	2760	G.E.	DH	3	7300/6980-240/480
4	333	G.E.	H	1	13200/11000-2200
3	250	Packard	A	1	13200-2200
3	130	G.E.	H	1	19000/9500-550/2200
3	100	G.E.	H	1	33000-2300
3	100	Whse.	Auto	1	4160/2400-2400/1385
3	50	Al.Ch.	OISC	1	22000-220
2	50	Wagner	HE	1	13200/11880-575/287
2	37½	Uptegraff	HD	1	2300-115/230
1	13	Kuhlman	Dry	1	480-240
5(new)	3	Al.Ch.	OISC	1	2400-120/240

DRAW-OUT OIL CIRCUIT BREAKERS

(2) 600 amps, 15,000 Volt G.E. type FKR-255-B, 250,000-KV int. capacity, complete.
(1) 600 amps, 15,000 Volt G.E. type FK-46, 100,000-KV interrupting capacity, complete.

FREQUENCY CONVERTER SETS

Qu	Make		
1	750-KVA	Elec.Mchy.	440/3/60 to 440/3/180
2	1200-KW	G.E.	2300/3/60 to 460/3/30
1	1700-KVA	Whse.	2300/3/60 to 2500/3/24

The above complete with control panels and starting equipment.

Member
AMERICAN REBUILDERS ASSOCIATION
Member Body
AMERICAN STANDARDS ASSOCIATION

T. B. MAC CABE COMPANY

4314 CLARISSA STREET — Phone DAvenport 4-8300 — PHILADELPHIA 40 PENNA

There's more than 40% to 60% SAVINGS on

SCHOONMAKER DEPENDABLE DIESEL POWER

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Each Schoonmaker-sold Diesel Engine Unit is fully REMANUFACTURED in our plants by highly skilled, factory-trained Diesel engineers. Only genuine factory-made and approved parts are used and all RE-MANUFACTURING is in strict accordance with manufacturer's recommended procedures. Prior to shipment every engine is subjected to a FULL LOAD operating test in accordance with DEMA standards.

The Schoonmaker Plants and Warehouses located in Jersey City, N. J. and Sausalito (San Francisco), California give NATIONWIDE SERVICE from Coast to Coast with modern, efficient and reliable facilities.

Our reputation and many years of experience and SPECIALIZATION in Diesel power equipment gives you value that money cannot buy elsewhere.

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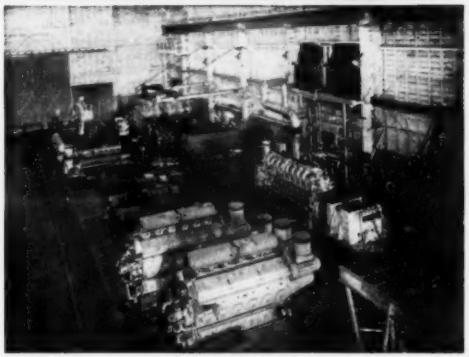
A.G. SCHOONMAKER CO., INC.

52 CHURCH ST., NEW YORK 7, N. Y.

PLANTS AND WAREHOUSES:
JERSEY CITY, N. J. AND SAUSALITO (S.F.), CALIFORNIA



PORTION OF ENGINE REMANUFACTURING FLOOR AND ONE OF THE ENGINE TEST STANDS AT OUR SAUSALITO, CALIF. PLANT.

A PARTIAL LIST OF OUR INVENTORY

KW	MAKE	MODEL	HP	RPM
1500	Fairbanks Morse	33E16	2000	300
1230	Nordberg	F6G168SC	1750	327
1136	Fairbanks Morse	38D	1600	720
1000	General Motors	16-278A	1600	720
750	General Motors	12-567	1080	720
500	General Motors	8-278A	750	720
500	Alco	6-12½x13T	750	600
500	General Motors	8-567	720	720
350	Baldwin	VO-6	510	450
320	Buckeye	80	480	600
320	Enterprise	DSG-6	460	450
300	General Motors	8-268A	450	1200
200	General Motors	8-268A	350	900
167	Ingersoll-Rand	S	255	600
160	Buckeye	80	240	600
100	General Motors	3-268A	150	1200
100	Worthington	BB-5	150	600
60	General Motors	6-71	90	1200
30	Inter. Harvester	UD-14	45	1200

ALTERNATING AND DIRECT CURRENT UNITS STANDARD AND SPECIAL VOLTAGES AS REQUIRED

ONE YEAR GUARANTEE!

TURBINE GENERATOR UNITS
3 Phase 60 Cycle

25000 KVA G.E. Cond. 250 lbs. 13200 volts.
21500 KVA G.E. Cond. 250 lbs. 2400 volts.
18750 KVA A.Ch. Cond. 200 lbs. 13200 volts.
6250 KVA A.Ch. Cond. 200 lbs. 4160 volts.
5000 KVA G.E. Non-cond. Extr. 600 lbs.—125 lbs. Extr. 50 lbs. Exh. 13800 volts.
5000 KVA West. Cond. Extr. 400 lbs.—50 lbs. Extr. 600 volts.
3750 KVA A.Ch. Non-cond. Extr. 400 lbs.—170 lbs. Extr. 50 lbs. Exh. 13800 volts.
2500 KVA West. Cond. 250/400 lbs. 2400 volts.
1563 KVA G.E. Cond. Extr. 200/400 lbs.—20 lbs. Extr. 2400 volts.
1250 KVA West. Cond. 450 lbs. 2400/4160 volts.
1250 KVA West. Cond. Extr. 200 lbs.—20 lbs. Extr. 480 volts.
625 KVA West. Non-cond. 200 lbs.—15 lbs. Exh. 480 volts.

ENGINE GENERATOR UNITS
3 Phase 60 Cycle

770 KVA Skinner Uniflow, 150 lbs. 2300 volts.
750 KVA Ames Vert. Uniflow, 150 lbs. 4160 volts.
625 KVA Skinner Vert. Uniflow 150 lbs. 480 volts.
625 KVA Skinner Uniflow, 150 lbs. 240 volts.
312 KVA Skinner Uniflow, 150 lbs. 480/240 volts.

DIESEL GENERATOR UNITS
3 Phase 60 Cycle

1250 KVA General Motors, 2400 volts, 720 rpm.
1000 KVA DeLaVergne, 2400 volts, 200 rpm.
700 KVA Fairbanks-Morse, 2400 volts, 300 rpm.
600 KVA Fairbanks-Morse, 2400 volts, 300 rpm.
475 KVA Cooper-Bessemer, 2400 volts, 400 rpm.
300 KVA Worthington, 208-120 volts, 450 rpm.

GENERATORS
3 Phase 60/240 Cycle

2250 KVA G.E. 60 cy. 2400/480 volts, 3600 rpm.
2859 KVA (3) G.E. 180/240 cy. 2300/4150 volts, 3600/4800 rpm.
4600 KVA G.E. 90 cy. 2400 volts, 5400 rpm.

STEAM BOILERS

100,000 lbs. per hr. Badenhausen, 170/700 lbs. pulv. coal.
50,000 lbs. per hr. B. & W., 420 lbs., pulv. coal.
30,000 lbs. per hr. B. & W., 435 lbs., gas or oil.
20,000 lbs. per hr. B. & W., 175 lbs., stoker coal.

TRANSFORMERS
60 Cycle

2,500 KVA (2) Mol. 1ϕ, 110,000-480 volts.
1,000 KVA (5) G.E. 3ϕ, 12000-4160 volts.
1,000 KVA (3) West. 1ϕ, 6900/11950-2300 volts.
667 KVA (3) Mol. 1ϕ, 19920/34500-2400 volts.
600 KVA (3) G.E. 3ϕ, 11000/22000-230/460 V.
500 KVA (6) G.E. 1ϕ, 33000-6600-2300 volts.
500 KVA (3) West. 1ϕ, 13800-2300 volts.
350 KVA (3) G.E. 1ϕ, 24000-480 volts.
150 KVA (3) West. 1ϕ, 19050/33000-2300 volts.
150 KVA (3) Allis 1ϕ, 13800-240/480 volts.
100 KVA (3) Pgh. 1ϕ, 7200/12500-120/240 V.

SYNCHRONOUS CONDENSER

7,500 KVA G.E., 3 phase, 60 cycle, 13800/6900/4000/2300 volts, 720 rpm.

INTERNATIONAL POWER MACHINERY CO.

1609 UNION COMMERCE BLDG. Telephone: MAin 1-9514 CLEVELAND 14, OHIO

STEAM POWER PLANT

5—714 HP Combustion Engineering WATER TUBE BOILERS, with Ebasco Superheaters, Sturtevant High Pressure Economizers, Green Chain Grate Stokers, Hagan Combustion Controls, Copes Feed Water Regulators, Clarage Forced Draft Fans, Sturtevant Induced Draft Fans, Smoke Stacks. Good for 250# pressure by Hartford.

1—765 HP Stirling 4 drum Boiler with B&W Superheater, Green Chain Grate Stoker, Sturtevant Economizers, Sturtevant Induced Draft Fan, with Smoke Stack. Good for 250# pressure by Hartford.

2—8000 HP Webster Water Heaters.

1—McCaslin Pivoted Bucket Conveyor System for handling coal and ashes. Approximately 300' long.

6—Steel Coal Bunkers, 80 tons each.

1—30" Wheeler Single Stage Circulating Pump, 30,000 GPM direct connected to 300 HP Allis-Chalmers Motor, 3/25/440, 360 RPM. (Has extra impeller for 15,000 GPM)

1—24" Dayton-Dowd Centrifugal Pump direct connected to 125 HP General Electric-Curtis Steam Turbine.

1—100 KW General Electric 125 Volt DC Generator direct connected to a General Electric-Curtis Steam Turbine, 2-stage with reduction gear, type SG, 3600 to 1200 RPM.

1—Type 1A-06 Wheeler Turbo Air Pump direct connected to 75 HP General Electric-Curtis 2-stage Steam Turbine, 1750 RPM.

1—6" Wheeler Centrifugal Condensate Pump direct connected to a 20 HP General Electric-Curtis 2-stage Steam Turbine, 1800 RPM.

1—Combination Circulating Pump and Condensate Pump driven by 100 HP General Electric single stage Steam Turbine through a Westinghouse Reduction Gear, 3500 to 700 RPM.

1—6" 2-stage LeCourtney Centrifugal Pump, 200 GPM 600 Head at 3,000 RPM direct connected to 55 HP Westinghouse Steam Turbine.

1—3000 KVA General Electric Synchronous Converter, Type HGC, 6 phase, 25 cycle, 250 RPM, 600 Volts DC with 1—1500 KVA General Electric Transformer, 3 phase, 25 cycle, 6600/13200-445 Volts with starting panel and all instruments.

1—1000 KVA General Electric Synchronous Converter, Type HGC, 6 phase, 25 cycle, 750 RPM, 600 Volts DC with 1—1050 KVA General Electric Transformer, 3 phase, 25 cycle, 13200-445 volts with starting panel and instruments.

1—500 KW Westinghouse Synchronous Converter, 6 phase, 60 cycle, 1200 RPM, 600 Volts DC with starting panel and instruments.

1—4000 KVA Westinghouse Transformer, 3 phase, 25 cycle, 13200/6600 volts.

7—700 KVA Westinghouse Transformers, single phase, 25 cycle, 7620/6600 volts to 13200 volts.

1—Kennecott Pressure Type Industrial Water Filter.

1—50-Ton Electric Traveling Crane—85'3½" Span.

Send for Complete Inventory

MORSE BROS. MACHINERY COMPANY

2900 BRIGHTON BLVD.

P.O. box 1708, DENVER, COLORADO

MOTOR GENERATORS

1—400 KW G.E. Syn. 600 V. 720 RPM
2—300 KW WEST. Syn. 250 V. 1200 RPM
1—300 KW RIDGWAY Syn. 250 V. 1200 RPM
1—240 KW G.E. Syn. 250 V. 1200 RPM
1—225 KW G.E. Syn. 125 V. 1200 RPM
1—200 KW G.E. Syn. 250 V. 1200 RPM
1—200 KW RIDGWAY Syn. 250 V. 900 RPM
1—150 KW G.E. Syn. 250 V. 1200 RPM
1—150 KW WEST. Syn. 250 V. 1200 RPM
1—100 KW RIDGWAY Syn. 250 V. 1200 RPM
1— 50 KW G.E. Ind. 250 V. 1200 RPM

ROTARY CONVERTERS

1—500 KW WEST. Syn. 250 V. 1200 RPM
2—300 KW Al-Ch. Syn. 250 V. 1200 RPM
1—200 KW G.E. Syn. 250 V. 1200 RPM
1—150 KW G.E. Syn. 250 V. 1200 RPM
1—150 KW WEST. Syn. 250 V. 1200 RPM

WALLACE E. KIRK COMPANY

502 Grant Bldg., Pittsburgh 19, Pa.

DIESEL GENERATOR SETS

100 KW General Motors Model 3-268A direct coupled to: Westinghouse Alternators, 3/60/440 V., 1200 RPM. Inc. Switchboards. Rebuilt.

60 KW General Motors set, Model 6-71, 6 Cyl., 3/60/120/208 V., 1200 RPM.

50 KW Int'l. Harvester set, Model UD-14, 4 Cyl., 3/60/120/208 V. Rebuilt.

Other sizes in stock, AC & DC Units

ALJON ELECTRIC DIESEL CO.

904 Pacific St., Brooklyn 16, N. Y.

STerling 3-6515

ELECTRICAL EQUIPMENT

REBUILT AND GUARANTEED

PROMPT SHIPMENT — PARTIAL LISTING

Electrical Equipment ~ Rebuilt and Guaranteed ~ Motors ~ Generators ~ M-G Sets ~ Transformers ~ Controls ~ Motors ~ Generators ~ M-G Sets ~ Transformers ~ Controls ~ Electrical Equipment ~ Rebuilt and Guaranteed

250 VOLT DYNAMOMETERS

Cradle Type With Scale and Control

Write for Complete Specifications

Qn.	Make	HP	RPM	Type
1	G.E.	150	2200/5000	TLC-50
2	West.	150	2200/5000	SK-131
1	G.E.	200	1200	C

SLIP RING MOTORS—3 Ph., 60 Cy.

Qn.	HP	Speed	Volts	Make	Type
6	7½	810	550	G.E.	MTC-520
2	10	1140	440	West.	HF-7A
2	10	570	220	G.E.	HI-11
2	11‡	820	550	G.E.	ITC-5008
1	15	570	220	West.	CW-646
1	18	680	440	West.	MW-316
1	20	860	440	West.	CW-638
1	25	1130	550	G.E.	MT-323
2	25	850	220	Wagner	BR
2	25	720	440	Wagner	22VBR
1	30	865	440	West.	CW-646
1	30	850	440	G.E.	MT-332
1	30	675	440	G.E.	MT-336
2	35	600	400	F-M	HV-H16A
2	40	865	2200	Al. Ch.	ARY-223C
1	40	560	440	G.E.	MT-346
1	50	1150	440	G.E.	MT-536
1	50	570	440	G.E.	MT-552
1	60	685	440	West.	CW-758
1	60	570	550	G.E.	MTC-5546
1	60	345	550	West.	CW-938
1	80‡	575	440	G.E.	MTC-5352
2	125	430	440	G.E.	IL-16
1	150	1750	440	G.E.	MTP-549
1	175	505	550	West.	CW-1002
1	200	495	2200	G.E.	IM-17A
1	250	600	2300†	G.E.	IM-17
3	300	900	440	G.E.	IM-17
2	300	880	2200	G.E.	IM-17A
4	350	1775	2300	G.E.	IM-E15A
1	400	505	550	West.	CW
1	600	1770	440*	G.E.	IM-E15C
1	700	735	4000‡‡	West.	CW

220 volt meters can be reconnected for 440 volts.
‡Intermittent rating. ‡‡25 cycle.
**New. †Also 440 or 550 volts.
*Also 2300 volts.

A.C. GENERATORS — NEW

3 Phase, 60 Cycle, 0.8 P.F., Two Bearing, with Damper Winding. Direct Connected Exciter.

Qn.	KVA	RPM	Make	Volts
1	18.7	1800	Columbia	240/120
4	18.7	1800	Columbia	208/120

230 VOLT CONST. SPEED D.C. MOTORS

Qn.	HP.	Speed	Make	Type
10	3	850	Reliance	T-25U
6	3½	850	West.	SK-30
1	7½	1150	G.E.	CDM-66
2	7½	850	G.E.	CD-75
10	10**	1750	Kimble	BA-324
5	10**	1150	Al. Ch.	ED-80
2	10	850	West.	SK-83
10	13½**	600	West.	SK-93
3	15	1750	G.E.	CD-75
1	15	825	West.	SK-90
1	20	1750	L.A.	ONA-L851
1	20**	1450	G.E.	CDM-83
1	20	1750/1310	West.	SK-83
2	20	1150	G.E.	RC-30
1	20**	1450	G.E.	CDM-83
1	20	750	West.	SK-110L
17	25	825	West.	SK-120
1	30	1100	G.E.	RC-12
1	40	1200	West.	SK-103
1	40	750	G.E.	RC-34
1	50	750	West.	SK-150
1	50	850	G.E.	RC-16
2	200	1150	G.E.	RC-38
1	250	1150	C.W.	CMC-101

230 VOLT ADJ. SPEED D.C. MOTORS

Qn.	HP.	Speed	Make	Type
6	5/7½	600/1800	G.E.	RA-30
1	10	400/1600	Reliance	T-92T
1	12½	280/840	West.	SK-130
1	15	600/1200	West.	SK-100L
1	20	500/1500	G.E.	RF-11
1	20, 25	300/1200	West.	SK-153
1	25	400/1600	G.E.	RF-13
1	25	500/1500	G.E.	RF-12
1	23, 29	300/1200	G.E.	RF-13
1	30/40**	400/1600	G.E.	CD-1236
1	35	500/1500	West.	SK-143
1	40, 50	400/1200	West.	SK-163
1	75	375/750	Cr. Wh.	CMC-125H
1	100	225/900	G.E.	MPC-A
5	100	400/1200	Al. Ch.	
1	100	320/960	West.	SK-200
1	125	450/1600	West.	SK-190
1	175	230/550	West.	SK-220
2	375	350/550	G.E.	MPC

**New

SQUIRREL CAGE MOTORS—3 Ph., 60 Cy.

Totally Enclosed Fan Cooled, Ball Bearing

Qn.	HP	RPM	Volts	Make	Type
4	2	1140	220	L.A.	JS-225Y
3	3	1160	440	L.A.	JS-254
4	5	1730	440	G.E.	K-254
2	7.5	1740	440	G.E.	K-284
1	10	1735	440	West.	CS-324
1	10	1140	440	Wagner	CP2-326
1	15	1175	440	L.A.	JA-365
1	20	1760	220	G.E.	K-364
1	25	1200	550	G.E.	K-405
1	25	1170	220	L.A.	LX-405
1	25	705	440	West.	CS-W504

SPLASHPROOF, BALL BEARING

Qn.	HP	RPM	Volts	Make	Type
1	3	1160	440	L.A.	FS-254
23	5	1750	440	L.A.	FS-254
1	5	1735	220	G.E.	K-254
1	5	1160	440	L.A.	FX-284
4	15	1150	440	L.A.	FX-365
1	50	1760	440	L.A.	FX-445A
4	50	1160	220	G.E.	K-504
1	150	1775	440	L.A.	FX-1168
2	150	880	440	L.A.	FX-1368
1	150	709	440	G.E.	KF-6335

OPEN TYPE MOTORS

Qn.	HP	Speed	Volts	Make	Type
3	10	3500	440	G.E.	KT-56
5	15**	1735	440	Century	SC326
1	15	1200	220	G.E.	KT-502
1	15	900	220	G.E.	FTR-512
1	20**	3475	220	West.	CS-326
6	20**	1750	440	Wagner	RPI-364
1	20	1750	220	West.	CS-W364
2	20	1200	220	G.E.	KT-512
2	20	1160	440	West.	CS-464C
2	20	900	220	G.E.	FTR-522
5	25**	1740	440	Century	SC-364
1	25	1160	440	West.	CS-667C
1	25	900	220	Howell	SCRB-356***
1	25**	875	440	Master	PB-405
2	25	575	440	G.E.	KT-542
3	30	3550	550	G.E.	K-3648
1	30	1755	220	G.E.	FT-513
1	30	1160	440	West.	CS-644
1	30	870	220	West.	CS-646
1	40**	3545	220	G.E.	KF-4048
2	40	1750	440	West.	CS-583C
2	40	900	2300	G.E.	FT-536
4	50**	1750	440	Wagner	RP5-405
2	60*	1750	440	Ideal	AH-444
2	60	900	440	G.E.	KT-346
1	75	1775	440	West.	CS-505
2	75	870	220	West.	CS-766A
2	75	885	2300	G.E.	KT-352B
2	100	1200	220	West.	CS-930
1	100	495	2200	Al.Ch.	AN
8	125	1750	2300	Al.-Ch.	AR
1	125	435	440	Al.Ch.	AR
2	125	400	2300	G.E.	I-17-FR
1	200	580	550†‡	G.E.	KT-5668
2	300	587	2200	West.	CS-39A
1	500	1200	140	G.E.	KTP-567
1	700	1800	2300/ 4000	West.	CS-4-39D12

220 volt motors can be reconnected for 440 volts.
**New. ***2 Phase. ‡‡Reconnectable for 440 volts

MOTOR GENERATOR SETS

125 and 250 Volts D.C.

(Write for complete Specifications)

KW	Make	RPM	DC Volts	AC Volts
2	Cont.	1750	125	220/440
7.5**	West.	1455	125	380/220‡
10	West.	1760	125	220/440
15**	G.E.	1800	125	220/440
15	G.E.	1755	250	220/440
15	West.	1450	125	220/440‡
16	West.	1760	125	2200/440
25	G.E.	1200	125	220/440
30	Al. Ch.	1750	125	220/440
50	G.E.	1720	125	220/240‡
75	G.E.*	1200	125	220/240
100	West.	1160	125/250	2300/4100

Note: 3KW, 5KW & 7.5KW, 250V Sets Available.
*New. *Synch. Motor Driven. §50 Cy. ‡25 Cy.

Above Items Represent a Partial Listing Only. Your Inquiries Will Receive Our Prompt Attention. All Equipment is Located in Our Cleveland Warehouse. We have Controls for Most Items Listed.

ELECTRIC GENERATOR & MOTOR CO.

4521 HAMILTON AVENUE • CLEVELAND 14, OHIO

MOTORS - M.G. SETS - CONTROL

NEW AND GUARANTEED REBUILT

SYNCHRONOUS

HP	RPM	Volts	Mfg.	Type
600	1800	2300	G.E.	100%
400	900	2300	Whse.	80%
200	900	440	E-M	80%
150	200	440	G.E.	80%
150	180	440	G.E.	100%
150	900	2300	G.E.	100%

SLIP RING

HP	RPM	Volts	Mfg.
700	514	2300	G.E.
500	1200	220/440	Elliott (new)
350	450	2300	Whse.
200	450	2300	Burke
100	1160	440	G.E.
75	720	220	G.E.
50	720	220	Whse.

M-G SETS

KW	D.C. Volts	A.C. Volts	Mfg.
500	125/250	2300	Whse.
400	125/250	2300	Whse.
250	240	2300	G.E.
150	250	440	Whse.
100	275	2300	Whse.
50	250	440	G.E.
40	250	220/440	G.E.
30	125/250	2300/4000	G.E.
7½VS	250	220/440	Rel.
3VS	250	220/440	Rel.

NEW MAGNETIC SLIP RING CONTROL

1—ALLIS 250 HP, 440 volt (125 HP, 220 volt) Reversing, 7 accel. steps, main line air ckt. brkr., fully magnetic, open or enclosed.

CRADLE TYPE DYNAMOMETERS

1—225 HP, Whse., 250 v. D.C., 300/2000 RPM, complete with Toledo automatic printing type scale and all necessary control.

1—150 HP, Whse., 275 v. D.C., 3000/4000 RPM, Frame 121, complete with all necessary control.

A.C. CONTROLS

1—700 HP, 4000-3-60, West. manual reduced voltage starter.

1—500 HP, 4600-3-60, G.E. CR-1034 manual reduced voltage starter.

6—General Electric Size 7 magnetic contactors

1—250 HP, 2300-3-60, G. E. CR-7006 magnetic starter, NEMA 1 encl.

1—150 HP, 2300-3-60, G. E. CR-7160 magnetic reduced voltage starter with high tension fuses (in cubicle).

1—100 HP, 4000-3-60, G. E. magnetic, full voltage starters.

2—G. E. Size 5 magnetic starters, 220 or 440 volts, NEMA 1 encl.

1—75 HP EC&M automatic compensator 440-3-60

1—50 HP EC&M automatic compensator 440-3-60.

2—NEW C-H 25 HP, 440 volt, magnetic reduced voltage starters.

3—NEW C-H 15 HP 440 volt, magnetic reduced voltage starters.

NEW DIRECT CURRENT

230 volt-dripproof

Qu.	HP	RPM	Mfg.	Frame
10	5	850/1700	G.E.	CD-66
3	7½	575/1725	G.E.	CD-77
1	7½	1750	Rel. (TE)	14T
1	10	575/2300	L.A.	4051
1	25	400/1600	F-M	open
1	25	500/1500	F-M	open

230 V. DIRECT CURRENT

Reconditioned & Guaranteed

HP	RPM	Mfg.	Brgs.
100	450/1350	Whse.	SI.
65	400/1200	Rel.	SI.
50	300/900	G.E.	SI.
50	500/1500	G.E.	SI.
40	400/1200	Rel. (TE)	Ball
35	400/1200	Ideal	SI.
30	250/1000	Whse.	S.SI.
30	350/1050	Whse.	SI.
30	500/1500	Rel.	Ball
25	500/1500	C-W	Ball
25	600/1350	Rel.	Ball
20	250/1000	Whse.	SI.
20	300/1200	Rel.	Ball
20	500/1500	G.E.	SI.
15	250/1000	G.E.	SI.
15	400/1600	Whse.	SI.
15	575/1725	L.A.	Ball
15	700/1350	Rel.	Ball
10	300/1200	Whse.	SI.
10	400/1600	Whse.	SI.
10	850	Rel.	Ball
7½	200/1200	Whse. (TE)	Ball
7½	300/900	G.E.	Ball
7½	400/1600	Whse.	Ball
7½	600/1800	Rel. (TE)	Ball
5	400/1200	C-W	SI.

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BOSWICK ELECTRIC CO.

P.O. BOX 55 AKRON 9, OHIO

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"Export Orders Carefully Executed"

IMMEDIATE DELIVERY

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1—80,000# hr. Steam Generator 350#. Very efficient, economizer, air heater, etc. Steel cased, excellent condition.

1—768 HP B&W Sterling Boiler, 200#, with new tubes.

● We have many other boilers in sizes of 250 to 600 HP, 230 to 450# pressure. See our September Power ad.

Turbo-Generators, Condensing, 300 to 20,000 KW. Non-Condensing, 200 to 2500 KW. Frequency Changers Motor-Generators & Diesel-Generators See our September Power Ad

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REFRIGERATION UNIT

275—Ton Ingersoll-Rand barometric steam jet refrigeration unit, fully comp. with centrifugal pumps, motors, and all accessories and fittings. New 1943, used 2 yrs. cond. like new. Detail specif. and price will be mailed on request.

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We carry a large stock of transformers, and invite your inquiries. New Transformers built to your specifications.

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We rewind, repair and redesign all makes and sizes.

One Year Guarantee.

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SINCE 1912 **CINCINNATI 27, OHIO**

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Power plant equipment. Steam, Diesel, electrical, boilers, engines, turbines, generators, new or used.

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Jackson, Miss.

BOILERS 2—Keeler 125 HP, 150 lb. pressure, water tube, ASME with McClave Stokers; excellent condition, immediate shipment.

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2401 THIRD AVE., NEW YORK 51, N. Y.

SLIP RING MOTORS

220 or 440 volt, 60 cycle, 3 phase, slip ring Motors Rebuilt

H.P.	MAKE	TYPE	SPEED	DESCRIPTION
400	G.E.	I-M	1200	S. B.
300	G.E.	I-M	1200	S. B.
200	G.E.	I-M	1200	S. B.
150	G.E.	I-M	1200	S. B.
150	G.E.	I-M	1800	S. B.
100	G.E.	MT-300	1800	S. B.
100	G.E.	I-M	900	S. B.
100	G.E.	I-M	720	S. B.
100	G.E.	MT-343	1200	S. B.
75	G.E.	MT-343	1200	S. B.
75	G.E.	I-M	900	S. B.
75	West.	CW	720	S. B.
75	G.E.	I-M	720	S. B.
60	G.E.	MT-333	1800	S. B.
40	G.E.	I-M	1800	S. B.

BRAND NEW SQUIRREL CAGE MOTORS

Totally enclosed, fan cooled, explosion proof, open 220 or 440 Volt, 60 Cycle, 3 Phase

H.P.	MAKE	TYPE	SPEED	DESCRIPTION
150	G.E.	K-6328	3600	TEFCBB
150	G.E.	K-6329	1800	TEFCBB
125	G.E.	K-6326	1200	TEFCBB
100	West.	CS-5078	1800	TEFCBB
100	West.	CS-504	1800	B. B. open
75	West.	CS-504	3600	TEFCBBXP
75	A.C.	ARZ	1800	TEFCBB used
75	West.	CS-504	1800	TEFCBBXP
75	West.	CS-445	1800	B. B. open
75	F.M.	QS-445	1800	B. B. open
75	West.	CS-505	1200	TEFCBBXP
60	West.	CS-5045	1800	TEFCBBXP
60	G.E.	K-5948	1800	TEFCBBXP
60	L.A.	BG-44	1800	B. B. open
60	F.M.	QS-444	1800	B. B. open
50	Master	FB-40A	3600	TEFCBBXP
50	G.E.	K-445	1800	TEFCBB
50	G.E.	K-405	1800	S. B. drip
50	West.	CS-445	1200	S. B. open
50	G.E.	K-505	900	TEFCBBXP
40	A.C.	AR-444	3600	TEFCBBXP
40	G.E.	KF-3858	3600	B. B. splash
40	West.	CS-405	1800	TEFCBB
40	L.A.	K-405	1800	TEFCBBXP
40	G.E.	404	1800	S. B. open
40	Cr. Wh.	SC-445	1200	TEFCBB
30	G.E.	KF-3858	3600	B. B. splash
30	West.	CS-3858	3600	S. B. tplash
25	Line.-Weld	DBD-329	3600	B. B. open
25	West.	CS-364	1800	S. B. splash
25	G.E.	K-364	1800	S. B. drip
20	G.E.	K-364	1800	S. B. drip
20	L.A.	EX-364	1800	TEFCBBXP
20	G.E.	KF-404	1200	TEFCBBXP
20	G.E.	KG-405	900	TEFCBBXP
20	G.E.	KF-405	900	TEFCBBXP
15	L.A.	EX-326	1800	TEFCBBXP
10	West.	CS-284Z	3600	TEFCBB
10	Howell	EKBB-28-5	1800	TEFCBBXP
10	Reliance	AA-CB-324	1800	TEFCBB
10	West.	CS-324	1800	TEFCBB
10	West.	CS-324	1800	B. B. open
10	L.A.	EX-328	1200	TEFCBBXP
10	G.E.	K-364	900	S. B. drip
10	L.A.	R-1835	600	TEFCBB
5	G.E.	K-224	3600	TEFCBBXP
5	L.A.	EX-225	1800	TEFCBBXP

SQUIRREL CAGE MOTORS REBUILT

220 or 440 Volt, 60 Cycle, 3 Phase, Open

H.P.	MAKE	TYPE	SPEED	DESCRIPTION
200	Wagner	RP-2-28	1800	S. B.
200	Wagner		1200	S. B.
200	G.E.	K-564	900	B. B. new
150	West.	CS	1800	S. B.
150	G.E.	I-K	1200	S. B.
150	G.E.	I-K	720	S. B.
100	West.	CS	1800	S. B.
100	G.E.	I-K	1800	S. B.
100	G.E.	I-K	1200	
100	G.E.	KT-347	1200	S. B.
100	West.	MS	1200	S. B.
100	West.	CS	900	S. B.
100	G.E.	I-K	720	S. B.
75	West.	CS	1800	S. B.
75	West.	CS	1200	S. B.
75	G.E.	I-K	900	
75	G.E.	KT-343	1200	S. B.
75	West.	CS-WL-607	1200	S. S. B.
75	G.E.	KT-552	900	S. B.
75	G.E.	KT-352	900	S. B.
75	G.E.	KT-348	720	S. B.
60	G.E.	KT-333	1800	S. B.
60	G.E.	I-K	1200	S. B.
60	West.	CS	1200	S. B.
60	G.E.	KT-348	900	S. B.
60	G.E.	I-K	900	S. B.
50	G.E.	I-K	1800	S. B.
50	Cr. Wh.	25R	1800	S. B.
50	G.E.	KT-327	1800	S. B.
50	G.E.	KT-336	1200	S. B.
50	West.	CS	1200	S. B.
50	G.E.	KT-342	900	S. B.
50	G.E.	KT-346	900	S. B.
40	G.E.	K-444	1800	B. B.
40	G.E.	KT-323	1800	S. B.
40	West.	CS	1200	S. B.
40	G.E.	KT-336	900	S. B.
40	F.M.	B-H12D	900	S. B.
40	G.E.	KT-342	720	S. B.
35	Triumph	B-12	900	S. B.
35	G.E.	I-L	900	S. B.
35	G.E.	I-K	720	S. B.
30	G.E.	KT-312	1800	S. B.
30	West.	CS	1200	S. B.
30	G.E.	KT-332	900	S. B.
25	G.E.	KT-312	1800	S. B.
25	West.	CS-471	1800	S. B.
25	Century	SC-30	1200	S. B.
25	G.E.	I-K	720	S. B.
25	F.M.	B-H12-B	720	B. B.
20	West.	CS-384	1800	S. S. B. splash

We have in stock explosive proof motors 220/440/60/3 ranging in HP from ½ to 50 HP 900 to 1800 RPM.
We also carry in stock a large quantity of used electric motors from ¼ HP up to 500 HP., generators, transformers and control equipment. Upon receipt of your inquiries, we shall be glad to quote.

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We own and offer the following types of equipment now located at our warehouse:

1—50 H.P., 150 lb. Clayton Package Boiler
Erie City Economics—125, 170, and 200 H.P.
Fire Box Boilers—165 H.P.
Package Type Boilers—18, 30, and 100 H.P.
2 New Frederick Stokers—2500 lbs. of coal/hr.

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150-850-35' & 40x450x24' NEW Buildings
150-100-75 HP Slow Speed Sl. Rg. Motors
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190 HP NEW 3-drum 160# Boiler Never Used
80,000 Barrel Steel Storage Tank
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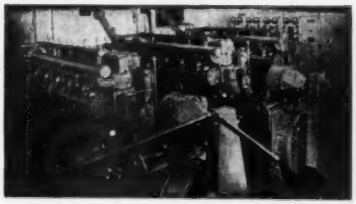

Each Plant consists of

3 Worthington Model BB 5—150 HP Diesel Engine Generating Units direct connected to Westinghouse Generators.
Rated 100 KW—125 KVA—3 phase, 60 cycle, 460 Volts, AC Current at 600 RPM.
Suitable for reconnection to 85 KW—3/50/230/400 at 500 RPM.
Complete with all accessories and auxiliaries including evaporative coolers—switchboard—distribution panel.

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GUARANTEED GOOD BECAUSE REBUILT AND TESTED BY HEMPHILL ELECTRICAL ENGINEERS

TRANSFORMERS—60 Cycle

Qu.	KVA	Make	Type	Ph.	Voltages
1	1500	GE	Pyranol	3	4150x2400
1	500	Kuhl.	OISC	1	4600x2300
1	333	GE	OISC	1	13200x230/440
1	200	GE	HT	3	2300x220
1	200	Pitts.	ODSC	1	4000x110/220
1	200	Mol.	C	1	2300x220/440
3	100	Wagner	HEB	1	2400x120/120
1	100	Amer.		1	15000x2300
3	100	GE	Auto	1	4150Yx2400Y
9	50	GE	H	1	13750x125x216Y
1	50	Al. Ch.	ODSC	1	13530x120/240
2	50	Pitts.	Sub	1	13530x120/240
1	50	Amer.	OISC	1	6600/13200x220/440
1	50	Amer.	WF	1	240x240/30
1	50	GE	K#	1	2300x230
1	50	Amer.	AT	1	220x220/44
1	37½	GE	H	1	2200x110/220
1	37½	Amer.	RS	1	6900/13800x220/440
1	37½	Amer.	OISCID	1	6600/13200x220/440
2	37½	Amer.	AT	1	220x220/44

MOTOR GENERATOR SETS

Qu.	KW	Make	Speed	DC	AC
7	1000	GE	514	600	2300/4150 Syn.
1	200	Whse.	900	250	220/440 Syn.

1	150	GE	1200	125/250	2300 Syn.
1	150	Whse.	600	125	4150 Syn.
1	125	CW	1200	125	220/440 SC
1	100	El. Mach.	1200	125	4150 Syn.
1	100	GE	900	250	2300 Syn.
1	94	GE	1200	60	440 SC
1	94	GE	1200	60	4150 Syn.

SYNCHRONOUS MOTORS

Qu.	H.P.	Make	Speed	Type	Volts
1	300	El. Mach.	720	TEFC	2200
1	150	GE	720	ATI	2300
1	150	GE	1800	TS	220
1	150	Whse.	900		220

SLIP RING MOTORS

Qu.	H.P.	Make	Speed	Type	Volts
1	250	Whse.	600	CW	440
1	200	GE	1800	MT	2300

SPECIAL—WELDING
1—150 KVA GE, type KWC, 1 ph., 550 V. sec. 12.22/6.05 V. Thryatron Spot and Seam. Control CR 7503

1	200	Whse.	600	CW	440
1	200	GE	600	MT	440
1	100	GE	400	IM	440
1	75	GE	1200	MT Vert.	220
1	60	GE	1750	MT	220
1	60	GE	900	MT	440
1	50	GE	1720	MT	220
1	50	Whse.	900	CW	220
1	50	GE	1700	MT	220
1	50	GE	600	MT	220
1	40	GE	1200	MT	220

SPECIAL M.G., A.C. WELDER
1—176 KVA Whse., 220 V. 57 PF. 1200 RPM. 1 ph., with 75 HP Slip Ring, 440V. type CW. Ext. & Control

Member of the National Industrial Service Assn., Inc.
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SPECIAL OFFERINGS

TURBO-GENERATORS
2—4000 KW, 2300 V., 150 #Cond.
1—3500 KW, 4000 V., 150# Cond.
1—4000 KW 2.00 V., 400# Cond.
1—3000 KW 13,200 V., 425# Extr. 170# Non-Cond.
1—2500 KW, 480 V., 150# Cond.
1—2500 KW, 550 V., 250# Cond.
1—1500 KW, 2300 V., 200# Cond.
1—1250 KW, 2300 V., 250# Extr.
1—1000 KW, 2300 V., 175# Extr.
1—1000 KW, 2300 V., 250# Cond.
1—1000 KW, 4150V., 280# N.C.
2—1000 KW, 480 V., 180# Cond.
1— 750 KW Consisting of
1—500 KW, 550 V., AC
1—250 KW, 250 V., DC
Non-Cond. 150#

DIESEL GENERATORS
1—1000 KVA, 2400 V.
1— 700 KW, 480 V.
3— 540 KW, 480 V.
1— 437 KW, 480 V.
1— 200 KW, 480 V.

FIRE PUMP
1—New 1000 G.P. Turbine Driven

BOILERS
1—1,000 HP, 250#
1— 438 HP, 200#
2— 300 HP, 250#
2— 250 HP, 200#
4— 150 HP, 150# Sq. Mr.
1— 78" H.R.T., 200#

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All Types and Sizes
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Also:—Aftercoolers, Air Receivers, V-Belt Drives.

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OIL COOLED
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REWOUND
REBUILT
RECONDITIONED

EXCELLENT POWER UNITS
2—125 KVA Westinghouse AC generators, 440 Volts, 277 RPM. Powered by 2 Bruce Mac Beth gas/gasoline engines.
1—150-HP, 225 RPM, Synchronous motor. Real Bargains.

A A A IRON CO.
Canton & Hawkins Sts., Dallas 1, Texas

M.G. SETS & CONVERTERS

KW	MAKE	RPM	D.C.	A.C.
750	Al. Ch.	720	250	2300
500	West. Rotary	1200	250	2300
400	West.	720	550	2300
300	GE	1200	250	2300
300	GE Rotary	600	250	2300
300 (2)	West.	1200	250	2300
300 (2)	Al. Ch. Rotary	1200	250	2300
300	West.	1200	550	2300
200	G.E.	1200	250	2300
200	West.	1200	250	2300
200	Ridg.	900	250	2300
200	G.E.	1200	125	2300
200	G.E. Rotary	1200	275	2300
150	West. Rotary	1200	275	2300
150	G.E.	1200	250	2300
150	G.E.	900	550	2300
150	West.	1200	250	2300
100	Ridg.	1200	250	2300
35	G.E.	1750	125	220/440

A.C. MOTORS

HP	MAKE	RPM	TYPE
400	GE	450	Sl. Rg.
300	GE	450	Sl. Rg.
150	GE	450	Syn.
100	West.	900	Syn.
100	West.	1200	Sq. Cg.
100 (2)	GE	1750	Sq. Cg.
100 (2)	GE	450	Sl. Rg.
75	West.	900	Sq. Cg.
60	West.	600	Sl. Rg.
50	GE	1750	Sq. Cg.
40	GE	900	Sl. Rg.
40	West.	900	Sq. Cg.
30	GE	1200	Sq. Cg.

PLATING M-G SETS
3—1500/3000 Amp. 6/12 Volts—AC Syn Motors
1—1500/3000 Amp. 6/12 Volts—AC Sq. C. Motor
1—1000 Amp. 75 volt 75 KW—AC Sq. C. Motor

MOORHEAD ELECTRICAL MACHINERY COMPANY
361 Noblestown Road (Est. 1919) Oakdale, Penna. Pittsburgh District

BOILERS

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NEW-USED
RECONDITIONED

Steam, Gas and Electric Power Equipment

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507 FIFTH AVE., NEW YORK CITY
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BREW-WOLTMAN OFFERS

TURBINE UNITS

1—15630 KVA G.E. Cond. 60 cy. 275-lb.
1— 9375 KVA G.E. Cond. 60 cy. 2300 V. 180-lb.
1— 6250 KVA Allis Cond. 60 cy. 4000 V. 175-200 lb.
1— 5000 KVA West. Cond. Extr. 60 cy. 480 V. 385-lb.
1— 3750 KVA G.E. Cond. 60 cy. 2300 V. 185-lb.
1— 2500 KVA Worthington Non-C. 60 cy. 2300 V. 150-200 lb. 40-lb. BP
1— 2500 KVA G.E. Extr. Cond. 60 cy. 480 V. 185-200 lb. Steel Valve Chest
1— 2500 KVA G.E. Cond. 60 cy. 600 V. 175-lb.
1— 1875 KVA West. Cond. 60 cy. 2300 V. 170-lb.
1— 1875 KVA G.E. Cond. 60 cy. 2300 V. 180-lb.
1— 1563 KVA G.E. Extr. Cond. 60 cy. 2300 V. 200-lb.
1— 1250 KVA Allis Cond. 60 cy. 2300 V. 150-200 lb.
1— 938 KVA G.E. Extr. Cond. 60 cy. 240 V. 200-lb.
1— 938 KVA West. Extr. Cond. 60 cy. 2300/4100 V. 200-lb.
1— 750 KVA G.E. Extr. Cond. 60 cy. 480 V. 200-lb.
1— 750 KVA G.E. Cond. 60 cy. 2300 V. 150-lb.
1— 625 KVA Worthington Non-C. 60 cy. 480 V. 125-lb. 10-lb. BP
1— 625 KVA West. Cond. 60 480 V. 150-lb.
2— 250 KVA Elliott Non-C. 60 cy. 208 V. 200-lb. 5-lb. BP

DIESEL ENGINE UNITS

2—1700 HP Gen. Motors 2300 V. 60 cy.
1—1800 HP Fair. Morse 2300/4150 V. 60 cy.
1— 600 HP Enterprise 440 V. 60 cy.
2— 500 HP Winton 2400 V. 60 cy.
1— 250 HP Buckeye 240 V. 60 cy.

STEAM ENGINE UNITS

2—500 KVA Ames Vertical Uniflow 2300 V.
1—250 KVA Ames Vertical Uniflow 480 V.
1—200 KVA Skinner Uniflow 230 V.
2—187 KVA Ames Vertical Uniflow 240/480 V.
1—156 KVA Ames Vertical Uniflow 240 V.

ROTARIES — 60 CY.

QU.	KW	MFR.	VOLTS-DC	TRANS.	RPM
1	3250	G.E.	225/285	13800	300
1	1500	G.E.	600	4150	600
3	1000	G.E.	600	13200	900 Auto.

SYNCHRONOUS CONDENSERS

QU.	KVA	MFR.	VOLTAGE	RPM
1	7500	G.E.	13800	720
1	2500	West	2400/4160	900
1	2000	West.	2300	720
1	1500	G.E.	4600	900
1	1500	West.	2300	900

MOTOR GENERATOR SETS — 60 CY.

QU.	KW	MFR.	VOLTS-DC	A.C.	RPM
1	2000	G.E.	600	4800	450
1	1500	G.E.	600	4150	600
2	1000	West.	660	4150	900
1	500	West.	125	2300	720
1	200	West.	275	2200	900
2	150	G.E.	250	2300	1200
1	150	West.	275	440	900
1	75	Ridgway	125	220	1200

SYNCHRONOUS MOTORS — 60 CY.

QU.	HP	MFR.	VOLTAGE	RPM
1	4350	Cr. Wh.	13800	514
2	700	West.	2300	200
1	600	G.E.	2300	1800
1	600	G.E.	440	360
1	300	G.E.	2300	600
1	300	West.	2300	900
1	250	Cr. Wh.	440	300

FREQUENCY CHANGERS

QU.	KVA	MFR.	CYCLES	RPM
1	3750	G.E.	25/60	300
1	3125	G.E.	25/60	300
1	2500	G.E.	25/62½	750
1	1875	A.C.	60/25	300
1	1700	West.	60/24	720
1	625	A.C.	25/60	300

OIL CIRCUIT BREAKERS — OUTDOOR

1— 600 A. 73 KV G.E. FHKO-236-500
1— 400 A. 37 KV G.E. FHKO-136-250
1— 400 A. 37 KV G.E. FHKO-236-500
4— 600 A. 15 KV G.E. FHKO-139-750
2— 600 A. 15 KV G.E. FHKO-136-1328 GS
1—1200 A. 15 KV G.E. FKO-139-350
1— 600 A. 15 KV G.E. FKO-139-350
2— 600 A. 15 KV G.E. FLO-15-250

MERCURY ARC RECTIFIERS

QU.	KW	KIND	DC VOLTS	TRANS.
2	4500	Multi Anode	800	13800
1	1000	Multi Anode	600	13800

TRANSFORMERS

3— 3333 KVA West. 132000—7620/13200 Y
3— 75 KVA A.C. 66000/24000—7200/12470 Y
1— 2500 KVA G.E. 59/73 KV—5 taps, 3 ph.
4— 2500 KVA West. 44000—11000
4— 1000 KVA West. 44000—11000
3— 150 KVA G.E. 44000—7200/12470
3— 100 KVA Wag. 44000—7200
3— 100 KVA G.E. 44000—2300
3— 75 KVA West. 44000—7200/12470 Y
3— 8333 KVA West. 43800—13900
3— 100 KVA Wag. 36000—7200/12470 Y
1—18750 KVA A.B.B. 34840—11000, 3 ph.
3— 150 KVA Wag. 33000—7200/12470 Y
3— 100 KVA A.C. 33000—7200/12470 Y
3— 100 KVA West. 33000—240/480 NEW
3— 75 KVA Wag. 33000—7200/12470 Y
4— 450 KVA A.C. 25110/44000—13280/23000
3— 1250 KVA G.E. 23000—2300/4000
3— 800 KVA G.E. 22000—2300
3— 100 KVA G.E. 22000—7200/12470 Y
9— 50 KVA G.E. 22000—2300
4— 750 KVA Wag. 19050/33000 Y—6900/11950
6— 200 KVA G.E. 13200—2300
2— 200 KVA G.E. 11500—220/110
3— 200 KVA Mel. 11000—2300
3— 250 KVA Pitts. 7200—220/440
3— 100 KVA West. 7200/12470 Y—2400
4— 50 KVA G.E. 7200/12470 Y—2300
3— 500 KVA Pitts. 6900/11900—550
3— 333 KVA Pitts. 6900/11900—550
3— 150 KVA Wag. 6900—2300
4— 100 KVA G.E. 6900/11900—2400
3— 37½ KVA G.E. 6900/11900—2400
2— 150 KVA West. 4800/8315 Y—480
3— 333 KVA G.E. 2300—230/460
1— 100 KVA G.E. 2300—575, 3 ph.
3— 100 KVA West. 2300—230/460
3— 75 KVA Mel. 2400—120/240
6— 50 KVA West. 2400—115/230 DRY TYPE
3— 15 KVA Stand. 450-225—117

PARTIAL LIST—WE HAVE ALL CLASSES OF POWER EQUIPMENT

BREW-WOLTMAN & CO., INC.

50 Church Street — New York City 7, — WOrth 4-1470

REBUILT MOTOR GENERATOR SETS

1—300 KW Ridgway Sync., 250 V—2300 V.
2—200 KW West. Sync., 250 V—2300 V.
1—100 KW G.E. Sync., 250 V—2300 V.
1—100 KW West. Sync., 250 V—2300 V.
1— 50 KW G.E. Sync., 250 V—2300 V.
1—22.5 KW West. Ind., 150 V—2300 V.

REBUILT TRANSFORMERS

6—150 KVA Packard 2400/4160—240/480
2—100 KVA Packard 2400/4160—240/480
3— 75 KVA Allis-Ch. 2400/4160—240/480.

TIPPINS MACHINERY CO.
PITTSBURGH 6, PENNA.

FOR SALE

MODERN 1000 KW Turbo-Generator

In Excellent Condition

Non-Condensing, Steel case 80# back pressure .8 P.F., 3 phase, 60 cycle, 4150/2300 volts, alternating current, complete with accessories, switchboard, oil circuit breaker, and direct connected exciter. Only operated alternately for six years. Ideal for Chemical, Rubber, Petroleum, Textile, Pulp and Paper, and Sugar Refining Industries.

NEWMAN & COMPANY, INC.
6101 Tacony St. Philadelphia 24, Pa.

COMPLETE POWER PLANT

4—600 H.P. Water tube boilers. Now operating. Foster Superheaters and Riley Spreader Type Stokers complete

TURBINE GENERATORS

American Brown Boveri 3 PH. 2300 V. 5180-KVA output speed 3600 cont. to 175 H.P. G.E. Synchronous Motor—3 ph. 60 cyc. 2300V

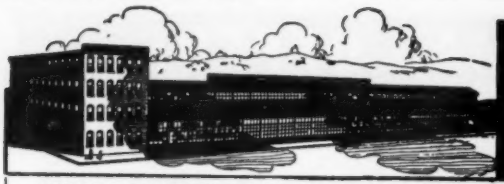
Allis-Chalmers Turbine 3 Ph.—6600V. 3125 KVA—2500 K.W.—V 2300

Allis-Chamers—Turbo Generators, 1875 KVA, 3 Ph. 60 Cyc. 2400V. 3600 R.P.M.

All the above equipment located at Mines No. 7 at Staunton, Illinois, Mine No. 15 at Mount Olive, Illinois, formerly operated by the Consolidated Coal Company.

WRITE OR WIRE FOR QUOTATIONS—SALESMAN ON PREMISES
LIST OF NEW CABLE ON REQUEST.

COAL MINE MACHINERY CO.
231 S. LA SALLE ST. ROOM 1257 CHICAGO 4, ILLINOIS



GLOW ELECTRIC CO.

927 HARRIET ST. CINCINNATI 3, OHIO
PHONE MAIN 3024

MEMBERS OF AMERICAN REBUILDERS ASSOCIATION, A MEMBER BODY OF AMERICAN STANDARDS ASSOCIATION

SQUIRREL CAGE, OPEN 3 PHASE MOTORS

HP	RPM	VOLTS	DESCRIPTION
750	900	6600	Westinghouse
350	3600	2200	Westinghouse
300	900	440	G.E.
200	490	2200	G.E.-I
125	3600	220/440	A-C
125	1800	2200	A-C
115	1200	440	G.E.
100	1800	2200	Westinghouse
100*	1200	2200	G.E.-KF544
100	1200	440	West.-CS
100	720	440	Westgh. 3 Brg.
85	3600	2300	G.E.
60	3600	2200	G.E.
60	1800	2200	G.E.
60	1200	440	Westgh. CS
50	1800	220	Triumph
50	720	2200	Westinghouse
40	900	440	G.E.
40	720	440	G.E.
35	3600	220	G.E.-KT
35	900	440	G.E.
30	720	220	G.E.
30	514	440	Stanley
25	3600	220/440	L-A
25	1800	220	L-A-MD
25	1200	220	Century
25	900	440	G.E.
25	720	220	Westinghouse
25	600	440	G.E.
20	3600	440	A-C
20	1800	220/440	G.E.
20*	1800	220/440	Wesche
20	1200	440	A-C
20	900	440	A-C
20	600	220	G.E.
15	3600	220	G.E.
15	1800	220/440	G.E.
15	1200	220	Imperial
15	900	220	Howell
15	720	220/440	A-C
10	3600	220	R. & M.
10	1800	220	Westinghouse
10	1200	220	A-C

* New Motors

SPECIAL

NEW DIESEL

Murphy ME650—165 HP, 1200 RPM 6 cylinder, 5¾ bore, 6½ stroke, complete. Will furnish engine only or as AC or DC Engine-Generator Set.

SLIP RING MOTORS

HP	RPM	VOLTS	DESCRIPTION
500*	900	4160	G.E.-M
400*	514	440	West.-CW
350	514	440	G.E., TE, FC, BB
300	1200	440	Westgh.-CW
300	720	2200	Al. Ch.
300	514	440	Al. Ch., 3 Brg.
250	600	2200	G.E.-117B
250	450	2200	C.-W.
250	450	2200	G.E.-I-17B
250	300	2200	Al. Ch.
200	1800	440	Al. Ch.
200	600	440	West.-CW
200	600	440	G.E.-IM
200	514	440	West.-CW
150	1800	440	G.E.-MT
150	720	2200	Al. Ch.
125	900	550	Ideal
100	720	440	Al. Ch.
100	400	440	West. Elec. (GE)

* NEW

MOTOR GENERATOR SETS

D.C. OUTPUT KW	Voltage	Description	A.C. INPUT HP	RPM	Volts
800	500	West., 3 unit	1200	1200	2300
750	550	G.E.,	1070	900	2300
750	500	Westgh.	1070	900	13200
600	250	Westgh. (2-300KW Gen.)	1200	1200	2300
600	250	G.E.	900	900	2300
400	250	Westgh.-G.E.	600	1200	220/440
300	250	G.E.	450	1200	2300
200	125	G.E.-Westgh.	300	720	2300
200	125	G.E. (25 cy.)	300	730	440
200	250	G.E.-Westgh.	300	1200	440
100	250	Westgh.	147	1700	4300
75	125	G.E.	115	1200	440
50	125	C-W	85	1800	440
47½	125	Al. Ch.	100	1200	2300
40	250	Westgh.-G.E.	60	1200	220/440
22	125	Al. Ch.	33½	900	220
20	115	G.E.-Al. Ch.	30	900	220
15	250	Al. Ch.-L.A.	25	1800	220/440
12½	230	Westgh.	18½	1800	220
10	250	Westgh.	15	1800	220/440
7½	125	Westgh.	10	1200	220

PLATING AND ANODIZING SETS

D.C. OUTPUT AMPS	VOLTS	RPM	DESCR.	A.C. END HP	VOLTS	DESCR.
7500/3750	6/12	270	Munning	80	440	West. CB Sq. Cage
4000	2 to 8	425	Jantz & Leist			
2400	40/80	1200	Westgh.	200	440	WH Sync.
1500	3 to 40	600	HVW	100	440	HVW Syn.
1500/750	6 12	1200	Munning Losb	15	440	GE— I Cage Century Cage
1000	80	1200	Century	100	440	
1000	20	1200	Star. I Brg.	—	—	—
1000	8	1200	Wagner	—	—	—
600	11	900	Westgh.	15	440	W.H. BB.
600	50	900	E-M	40	440	A-C
600	30	1200	W-E	30	440	GE
600	30	900	G.E.	25	440	GE
500	40	1200	G.E.	30	440	GE-KT
500	12	1200	Ideal	10	220	GE-KT
500	8	GE	Rectifier	—	440	—
416	12	1200	HVW	7½	440	GE-KT
400	40	1800	Hobart	25	220/440	Hobart
208	62	1800	G.E.	20	220/440	GE-KT

AC MOTORS IN STOCK — REBUILT GUARANTEED

3ϕ—220 or 440 V 60 Cycle

HP	RPM	MAKE	REMARKS
400	3600	West.	CS7113-6H SSB
100-(2)	1200	G.E.	K-546
100(4)	720	G.E.	I-K
75-(2)	900	G.E.	K-546
50	1800	C-W	BA4058 BBDP
40	1800	Al. Ch.	2061
30	1800	Imperial	EN
30	1800	West.	CS
30	1200	Lincoln	
25	1800	G.E.	KF365
25	900	R&M	K207
20	3600	G.E.	KT203Y
20	1800	G.E.	KG3364 Hi Torque
20	900	Wagner	15VRP
20(2)	600	G.E.	TEFCBB FT536
15	1800	G.E.	KG3326 BB Hi Torque
15	1800	G.E.	K326
15	900	R&M	L640
15	514	G.E.	KT552
10	1200	G.E.	KT302
10	1200	G.E.	I-K
10	1200	Burke	
7½	1800	C-W	113Q
7½	900	West.	CS
7½	900	G.E.	KT302

3ϕ—220 or 440 V 60 Cycle

HP	RPM	MAKE	REMARKS
5	1800	G.E.	K254 BBDP
5(2)	1800	G.E.	K254
5	1200	West.	CS284 TEFCBB
5	600	Watson	KH9

Additional Smaller Ratings.

Single Phase 60 Cycle 110 & 220 V

HP	RPM	MAKE	REMARKS
10	1800	Wagner	15TRA
5	1200	G.E.	5KT853
5	900	Century	R815
1½(5)	6500	B&D	Series, 230V
1	11000	B&D	Series, 230V
1	1200	Wagner	9WLBA
1	520	Sturt.	284MK
½	900	Sturt.	224
½	680	Sturt.	no feet
½	420	Sturt.	254
½	1800	Master	TE Mixer

SANDMAN Electric

SANDMAN ELECTRIC CO., INC.

665 PARKER ST., BOSTON 20, MASS.
SALES & SERVICE Tel. HIghlands 2-7600

AMERICAN

SINCE 1902
COMPRESSORS
VACUUM PUMPS
Good Compressors For 50 Years
YOUR CHOICE:
American—Bury—Chicago—
Curtis—Davey—Gardner
Ingersoll—LeRoi—
Penn—Schramm—
Sullivan—Worthington

HEAR-HERE
American Rebuilts
Are Best

AMERICAN AIR COMPRESSOR CORP.
Dell Ave., & 47th North Bergen, N. J.

COMPLETE DIESEL PLANT

3—Fairbanks Morse units 805 HP—556 KW; 690 HP—473 KW; 300 HP—200 KW. Model 33-E-14. 3/60/2400 volts New 1940. Will sell all or part. With auxiliaries. Condition excellent

MISSISSIPPI VALLEY EQUIPMENT CO.
507 Locust St. St. Louis 1, Mo.

COMPLETE DIESEL PLANT

2—250 KVA Venn-Severin—4 cyl—≅5800, ≅5308.
2—150 KVA Venn-Severin—3 cyl—≅4644, ≅5312.

3/60/440—327 RPM
Still on Foundations (new 1941)
Excellent Condition
$25.00 PER KVA

SAMUEL M. DAVIS
510 LA SALLE STREET
ST. LOUIS 4, MO.

EQUIPMENT FOR SALE

200 H.P. B. & W. 160± Boiler, 1933.
(2) Penn. Air Comp. 252 CFM 40 lb. 25 H.P.
(2) 30"x16' Amm. Condensers.
(1200) 300± Galv Ice Cans, Air tubes.
(4) 4696 sq ft Frick Vertiflow Coil units.
(4) 3 H.P. Vert. Brine Agitators.
160 Ton Vilter Elec. Amm. Comp. 250 H.P.
1500 G.P.H. Coch. IJS H.P. water Softener.

ALL IN FIRST CLASS CONDITION.

POWER ENGINEER
P.O. BOX 419
South Bend, Indiana

MOTORS • GENERATORS • TRANSFORMERS

7x7 AIR COMPRESSOR

Ingersoll Rand 7x7 Class ERI—100#—with or without drive.

1—400 KW Westinghouse 500 V. DC 750 RPM 800 Amps. Motor—580 HP. Synchronous 3 Ph. 25 cycle 440 V. 750 RPM.

ANODIZING M.G. SET

33 KW Gen. Elect. Type BR. Form C 60 V. DC. Direct connected to 50 HP 3/60/440/1800 Gen. Elect. Motor.

600 HP GEAR REDUCER

1—600 HP Farrel-Birmingham Herringbone Gear Unit. Type SL. Size 30/16 Speed 730 RPM to 115 RPM.

400 HP GEAR REDUCER

1—400 HP Nuttall (Westinghouse) Type LMR-25 Single Helical Heavy Duty Reducer—6-1 Ratio at 900 RPM with High Speed Shaft Extension for Brake.

400 HP SYNCH. MOTOR

1—400 HP Westinghouse Synchronous Motor. 3/60/2300/900 RPM. Unity P.F. with direct connected exciter—Late Type.

MOTORS

60-50-25 Cycle in Stock—All Sizes. Slipring—Squirrel Cage—Synchronous. All types of Control Equipment.

100 HP Westinghouse Slipring 3 Bearing 3/60/220/440/435 RPM.

100 HP Gen. Electric Type I form K 3/60/2300/600 RPM.

100 HP Gen. Electric Type KT 356 3/60/2200/900 RPM.

125 HP Gen. Electric Type I form K 3/60/440/720 RPM.

125 HP Gen. Electric Type KT 3/60/2300/1200 RPM.

150 HP Gen. Electric Type KT 3/60/440/500 RPM.

150 HP Gen. Electric Type I form K 3/60/2300/720 RPM.

150 HP Gen. Electric Type I form K 3/60/2300/900 RPM.

200 HP Gen. Electric Slipring Type I form M 3/60/440/600 RPM.

200 HP Gen. Electric Type KT 3/60/440/600 RPM.

250 HP Gen. Electric Type KT 3/60/440/720 RPM.

350 KW GENERATORS

2—350 KW General Electric Generators Type MPC, 250 Volt DC, 720 RPM Single Bearing Machines.

T.E.F.C. MOTORS

60 HP Westinghouse CS-607 3/60/440/900 X-Proof

50 HP Ideal New. 3/60/220/440/1800

2—20 HP Louis Allis ES. 365 3/60/220/440/1800 X-Proof

15 HP Louis Allis EX-364 3/60/220/440/1800 X-Proof.

DC CIRCUIT BREAKERS

1—1000 AMP. Condit. 2 Pole

1—1600 AMP. Condit. 2 Pole

1—1600 AMP. Westinghouse 2 Pole

1—3000 AMP. Westinghouse 2 Pole

125 VOLT DC MOTORS

1—100 HP Crocker Wheeler 125 Volt DC 850 RPM Ball Bearing

1—150 HP Crocker Wheel 125 Volt DC 850 RPM Ball Bearing.

Will make 1200 RPM 125 Volt Generators.

REBUILT TRANSFORMERS

3—100 KVA G.E. 1 ph., 60 cy. 2400/4160 pri. 120/240 sec.

3—1667 KVA Wagner 1 ph., 25 cy., 23,000 pri., 575 sec.

ERIE ELECTRIC CO., INC. 124 CHURCH ST. BUFFALO, N. Y. CL. 4758

BARGAINS

1—new, 75 HP., 3 phase, 60 cycle, 220 volt, CR7051-DIF General Electric reduced voltage automatic compensator. $765.00

1—rebuilt, 40-50 HP, 3 phase, 60 cycle, 440 volt, CR7051-J3 General Electric reduced voltage automatic compensator. $200.00

3—200 KVA, 13860-13200-12540 x 4600-2300 volt, 60 cycle 1 phase, type H form KDD Gen. Elec. transformers serial 3, 711-867-829. $2700.00 lot.

3—200 KVA, 13200-12540-11880x2400-2300 volts, type H form KDTQ, 60 cycle, 1 phase, serials 4.580.000. All guaranteed $2700.00 lot.

1—600 KVA, 3 phase, 60 cycle, 13800-13455-13110, 12765 12420x575 volts, type HT, form DH Gen. Elec. transformers with 11160 volts you can get 460 volts with 11500 volts you can get 480 volts. Guaranteed $2250.00.

1—20 KW, 220 to 550 volt, 3 phase, 25 cycle, to 60 cycle Gen. Elec. Generator driven by a 35 HP., 230 volt, type RCI3 Gen. Elec. motor, 750 to 1800 rpm., with control panel. $900.00.

1—2000 amp., 8 volt, Jantz & Leist interpole generator connected to a 20 HP., 3 phase, 60 cycle, 700 rpm., type KT332 Gen. Elec. motor, excitation 230 volts. $900.00.

1—62½ KVA, 220-440 volt, 60 cycle, 900 rpm., Gen. Elec., to a model D8800 Caterpillar diesel engine automatic voltage regulation. $3600.00

We carry a large stock of all kinds of direct current motors etc. What have you for sale?

What do you need?

KEYSTONE POWER PLANT EQUIPMENT CO.

8403 Hegerman St., Phila. 36, Penna.

TRADE WITH BAUER

BUY - SELL - TRADE your COMPRESSOR (VACUUM PUMP STEAM BOOSTER)

L.W.BAUER

765 ESSEX AVE. BLOOMFIELD N.J.

SPECIAL OFFER

Two complete turbo-generating units with complete structural steel base and supports.

GENERAL ELECTRIC A.C. GENERATOR Serials #135321 & #13536341, Type ATB, 2 KVA 1875, Speed 3600, Form "T", Amperes 164, KW 1500, Volts no load 6600, Volts full load 6600.

CURTIS STEAM TURBINE Serials #18967 &18966, KW 1500, Speed 3600, Form "B", 3 stage, 200# Steam Pressure, Condensing: P.F. 80%.

CONDITION: These units were completely rebuilt in 1942, and only operated less than one year, as can be certificated by the General Electric Co. We guarantee them to be in good operating condition.

1—25 KVA GASOLINE GENERATOR Mfgr: Westinghouse, Leroi engine, 120 volts, 1 phase, 900 RPM.

3—25 KW DIESEL GENERATORS Mfgr: Westinghouse, 450 volts AC, 60 cycle, 3 phase, 42.8 Amps, direct connected to 50 HP Winton Diesel, 3 cylinder.

8—132 KW TURBO GENERATORS Mfgr: Westinghouse (4), General Electric (4), 450 volts AC, 60 cycle, 3 phase, 1200 RPM, 256 Amps, 375# steam pressure, complete with reduction gear and 40 KW exciter.

2—STEAM TURBINES Mfgr: Westinghouse Serial Nos. 2-A-9229-133 & 134, 6819 RPM, 418 LB.G steam press, 18 LB.G back press, 7763 over speed test, 3100 S.H.P.

2—STEAM TURBINES Mfgr: Westinghouse, Serial Nos. 2-A-9230-133 & 134, 7797 RPM, 26 LB.G steam press, 25 IN. HG. back press, 8967 over speed test, 3100 S.H.P.

1—75 KW MOTOR GENERATOR SET. Two units 3 bearing.

Will sell complete or individually. Above units in First Class operating condition, complete with controls, panel boards, etc.

TRANSFORMERS

5 KVA to 750 KVA.

BOILERS

1—188 h.p. Bigelow 160 lb. wp 4 yrs. old.

1—150 h.p. Coatesville 150 lb. wp. 20 yrs. old.

Both units complete with modern automatic oil feed and firing systems.

1—250 H.P. B.W. Sterling Type Boiler, 200# Pressure complete with Coxe Traveling Stoker.

We own and offer a complete line of refrigeration, chemical, processing, and power equipment.

Send inquiries to:

KAPLAN MACHINERY CO.

Tioga & Edgemont Streets, Phila. 34, Pa. Ph. Ne 4-1210

SLIP RING MOTORS 3-Ph., 60 Cy.

HP	Volts	Make	Speed
500 (2)	2300	G.E.	900
500	2300	G.E.	450
450	440/220	Whse.	514
350	2200/440	G.E.	450
300	2200	G.E.	360
300	440	Whse.	3600
250	440/220	Whse.	600
250	2200/550	G.E.	450
250	550/440	G.E.	1200
250	440	G.E.	600
200	440	G.E.	450
188	4000/2300	G.E.	1800
150	440/220	G.E.	450
150	440/220	Whse.	600
150	440/220	Whse. (2)	1800
145	4000/2300	G.E.	1800
125	2200/440	G.E.	600
125	550/440	G.E.	1200
100	440/220	G.E.	600
100	440/220	G.E.	900

SYNCHRONOUS MOTORS 3-Ph., 60 Cy.

HP	Volts	Make	Type	RPM
400	440/220	G.E.	ATI	600
300	2200/440	G.E.	TS	720
300	440/220	G.E.	ATI	600
250	440/220	Whse.	HR	277
250	440/220	G.E.	ATI	600
250	4000/2300	El. Mchy.	Syn.	600
240	2300/440	G.E.	ATI	720
200	4150/2300	Whse.	G	1800
120	440/220	G.E.	ATI	900
110	440/220	G.E.	TS	257
100	440/220	Whse.	G	1800
75	2200/440	Whse.	GE	600

PLATING UNIT

1—5,000 amp., 4/8 volt (or 2,500 amps., 8/12 volts) A.P. Munning, double commutator dir. conn. to 50 hp. G.E. sq. cage motor.

CIRCUIT BREAKERS

2—2000 amp., GG E, 3 pole, 600 v., air
2—1600 amp., ITE, 3 pole, 600 v., air
2—1200 ampere, Whse., 3 pole, 600 v., air
1—400 amp., 37500 v., G.E., Type FHKO-236 outdoor type, high interrupting capacity.

SQUIRREL CAGE MOTORS

HP	Volts	Make	Type	Speed
650	440	G.E.	PT	3600
500	2200/4000	Elliot	SC	1800
350	2200	G.E.	KT	1200
300	2200	G.E.	PT	3600
250	440	G.E.	IK	720
250	2200	Al. Chal	AR	1800
200	2200	G.E.	K	900
200	410	G.E.	IK	720
200	440	G.E.	IK	514
200	440/220	Whse.	CS	1200
200	440/220	G.E.	KT	1800
150	440	multi sp	KT	1800/600
150	440/220	Whse.	CS	900
150	440/220	G.E.	IK	450
100	2200/550	Whse.	CS	900
150	440/220	G.E.	KT	720
150	440/220	Howell	R Rtg.	1800
150 vert.	440/220	G.E.	KTP	1200
150	440/220	G.E.	IK	514
150	3200/440	G.E.	KT	600
100	2200/440	G.E.	K	1200
75 (5)	550	G.E.	KF	1800

A. C. GENERATORS

1—320 kva. 600 rpm, 2300/440/220 V., G.E.
1—275 kva. 1200 rpm, 440 V., G.E.
1—250 kva. 720 rpm, 2300/440 v., G.E.
1—225 kva. 600 rpm, 220/440 v., G.E.
1—187 kva. 1200 rpm, 440 V., Whse.
1—150 kva. 900 rpm, 480/240 v., G.E.
1—100 kva. 720 rpm, 440 V., G.E.
3— 75 kva. 1800 rpm, 480/240 v., Whse.

D. C. MOTORS

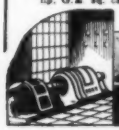
HP	Volts	Make	Type	Speed
250	230 (2 new)	Cr. Wh.	CMC	1800
225	230	G.E.	CD	600
150	230 (2)	Whse.	SK	850
125	230	Whse.	SK	350/1050
100	230	El. Dyn.	36-3	475/1350
100	230	Cr. Wh.	CMC	625
100	230	G.E.	CD	1750
75	230	G.E.	CD	1150
75	230	Whse.	SK	850

MOTOR GENERATOR SETS

1—250 kw, 1200 rpm, 250 V., Whse., conn. to 375 HP, 1200 rpm, 2200 V., syn.
1—175 kw, 1200 rpm, 230 V., G.E., conn. to 250 kva, 1200 rpm, 2200/440 V., syn.
1—100 kw, 1200 rpm, 240/120 V., Al. Chal., conn. to 150 hp, 440 V., sq. cage.
1—75 kw, 125 v., 1200 rpm, G.E. conn. to 120 hp, 2200/400 v., syn. motor.
1—65 kw, 1200 rpm, 250 V., G.E., conn. to 100 hp, 1200 rpm, 440 V., synchronous.
1—50 kw, 250/125 V., 1200 rpm, 3 wire, G.E., conn. to 75 hp, 440/220 V., sq. cage.

TRANSFORMERS 60 CY.

1—333 kva, G.E., 13,200—2300 V.
1—300 kva, Al. Chal. 4600/4160—240/120 V., 3 phase
1—250 kva, G.E., 2400-480 volts.
1—250 kva, Whse., 11,000/22,000—2300 V.
1—200 kva, Whse., 2400—240/120 V.
1—150 kva, Whse., SK, 12200-125/215 v., 3 ph.
3—150 kva, Al. Chal., 2400-240/120 V.
3—150 kva, Whse., 2400-240/480 V.
3—100 kva, Whse., 2400-240/480 V.
9—100 kva, Whse., 2400—120/240 V.
5—100 kva, G.E., 4156—120/240 V.
2—100 kva, Whse., 2400—120/55 V.
3— 75 kva, Whse., 2400—240/480 V.
3— 75 kva, Moloney, 4150—240 V.
6— 50 kva, G.E., 2400—120/240 V.
11—50 kva, Whse., 2300-110/220 V., dry



STEPHEN HALL & CO.

HARRY J. RICE PRES.

458 SEVENTH ST. HOBOKEN, N. J.

2—750 H.P. 200# B.&W. Stirlings. 1925. We have new tubes on location.

2—705 H.P. 200# B.&W. Stirling, 1918. We have new tubes on location.

2—500 H.P. 450 Lb. Walsh-Widener Sectional Header Cross Drum Water Tube Boilers, Complete with Superheaters, Boiler Feed Pumps, and all Miscellaneous Equipment. Built in 1928.

2—250 H.P. Erie City 3 Drum Low Head Boilers, 1942, 200 Lb. Working Pressure, Peabody Burners, Brooks Control Equipment, Pratt-Daniel Stack on each Boiler Pumps, Heater, and Piping.

1—200 H.P. Union Iron Works, 200#, Universal Economic type.

1—600 H.P. B&W Sect. Header Boiler, 200#.

1—150 H.P. Bros 150# w.p., 3 drum, Bent tube, self contained, steel encased, brick lined. 9000# steam per hour.

General Scotch Marine Boilers, 75 to 150 H.P. available.

1—500 H.P. Cleaver Brooks Package Boiler, 150 Lbs. #6 Oil, 1947.

A Number of Self Contained & Economic Units, 50-150 H.P., 100-200 Lbs. Pressure.

Combustion Engrg., Spreader Stoker complete with fan & Hagan Controls-Stoker. Designed for 600 H.P. boiler at 200% of rating, or 1200 H.P.

1—6 Cylinder Enterprise Diesel, 800 H.P. direct connected to 1000 K.V.A., 3 ph., 60 cyl., 2400 V. Elliot Generator complete with all aux. Unit built 1948, 1400 hrs. use only.

WARNER J. SHERB, INC.

342 Madison Avenue, New York, N. Y.
Telephone MUrray Hill 2-9098

---

400 KW Enterprise dual fuel engine generator complete with accessories—new 1948. $35,000.00.

3—GE 1000 KVA, 13200-2300 volt, 60 cycle, 1 phase, OISC, transformers, two 5% taps above 13200 volts, serial #1827018-19-20, in service at present, available June 1st, 1952 with accessories—$7500.00 lot total as removed from service.

3—Wathse. 150 KVA, 2400/4160-240/480 volt, 60 cycle, 1 phase, OISC transformers with accessories as removed from service May 15, 1952—lot total $3200.00.

ARTHUR G. PORTER
Lutsen, Minnesota

PUMPS—COMPRESSORS—BLOWERS

1—2000 GPM 350' Pump with 240 HP Turb.
1—750 GPM 231' Pump with 75 HP 3 ph. motor
2—675 GPM 428' Pumps with 125 HP Turb.
1—200 GPM 556' Pump with 50 HP 3 ph. motor
1—200 GPM 558' Pump with 50 HP Turb.
1—1100 GPM 220' Al.-Ch. Cent. Pump
4—2000-5000 GPM 32'-66', 10" & 12" Pumps
1—1000 GPM 280' all-bronze Cent. Pump
4—Kinney unused 6" Rotary Pumps
3—Blackmer 6" Rotary Pumps 500 GPM
3—750 & 1000 GPM Knowles Steam Pumps
1—8" x 10" A. L.—7" x 10" Triplex Pumps
1—3" x 8" Galland Hydraulic Triplex Pump
1—9" x 10" Gardner Duplex Pump 300 GPM
1—12" x 14" Duplex Air Compressor 850 CFM
1—12" x 10" 1-R Air Compressor 355 CFM
2—12" x 9" Worth. Comp. 375 CFM, Vac. & Press.
1—4-stage Norwalk Compressor 28 CFM 5000 PSI
1—Sturt. 60 H.P. Tur.-Blower 7000 CFM 20 oz.
1—GE 2-stage Turbo Blower 3000 CFM 16 PSI
1—Spencer 30 H.P. Tur. Blower 4000 CFM 16 oz.
1—60 H.P. DC 230 v. 1150 RPM comp. C-W Motor
1—30 H.P. DC 230 v. 1750 RPM ball.-bear Motor
10—Nash Vacuum Pumps and Vac.-Heating Units
250—Rebuilt Motors 1—200 H.P.
72—Exhaust Blowers, Fans, Unit Heaters
2—Kinney High-Vacuum Pumps, 100 C.F.M.

HUNDREDS OF OTHER ITEMS—ALL SIZES—ALL MAKES

SUPERIOR EQUIPMENT CO.

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2200 Volt, 60 Cycle, 3 Phase

2—1000 H.P., General Electric, K, 1800 RPM
2— 600 H.P., Westinghouse CW, 450 RPM
1— 100 H.P., Westinghouse CW, 870 RPM
1— 250 H.P., Westinghouse CS, 1200 RPM
1— 125 H.P., General Electric KT, 600 RPM
2— 75 H.P., Westinghouse CS, 690 RPM
3— 30 H.P., General Electric MT, 900 RPM, 220/440 Volt
2— 150 H.P., General Electric I-M, 450 RPM
1— 150 H.P., Westinghouse CW, 514 RPM
1— 100 H.P., Westinghouse CW, 600 RPM
1— 250 H.P., General Electric KT, 1800 RPM
1— 200 H.P., Westinghouse CS, 1200 RPM
2— 100 H.P., General Electric IE, 1800 RPM
2— 100 H.P., General Electric IE, 1200 RPM
2— 75 H.P., Westinghouse CS, 690 RPM
2— 50 H.P., General Electric KT, 900 RPM
2— 40 H.P., General Electric KT, 900 RPM
2— 40 H.P., General Electric KT, 1200 RPM
2— 30 H.P., General Electric KT, 1200 RPM
4— 25 H.P., Westinghouse CS, 900 RPM, Class 2, B.B.
1— 25 H.P., General Electric N444, 870 RPM

Many other ratings in slip ring, squirrel cage, vertical. Transformers, Compressors, Hoists, Pumps, etc. Several AC and DC Crane Motors.

E. P. DIETRICK
829 Richmont St., Scranton, Pa.

DIESEL AND GENERATOR

215-hp Venn-Severin Model M, 2-cycle, 327 rpm Air Comp. & Tanks, Heat Exchanger, etc.

156 KVA Ideal Elec. Flywheel-type Generator, 3/60/240/480 V, with 7½ KVA Exciter, Western Electric Control Panel, etc.

Excellent condition, less than 18,000 hours.

LEDBETTER MANUFACTURING COMPANY
ROCKINGHAM, N. C.

FOR SALE
AIR CIRCUIT BREAKER

Practically new. Westinghouse 3000 amp., 600 volt, 60 cycle, Type DA-75 Air Circuit Breaker. Price—$1000.00. Immediate Shipment.

ROGERS-SCHMIDT ENGINEERING CO.

1988 Railway Exchange Building, St. Louis 1, Mo.

BRUCE PEEBLES—SYNCHRONOUS MOTOR

B.H.P. 2500 volts 2300—Amps 555—R.P.M. 133.3 rating continuous 3 phase 60 cycle. Complete with Bruce Peebles exciter and Allen West liquid controller type L.35—$5000.00—where is and as is.

Write—Mr. Willis, The Ogilvie Flour Mills Co., Ltd., P.O. Box 6089, Montreal, Canada.

Price-Rathbun 600 H.P. special vertical 6 cylinder, 4 cycle, solid injection stationary diesel oil engine with direct connected 168 K.W. General Electric a.c. generator, power factor .8, 505 amps., 240 volts, 3 phase, 60 cycles, 225 r.p.m. Priced very reasonably.

THE NEW ERA MILLING COMPANY
Arkansas City Kansas

GENERATORS

1—Westinghouse—540 KW—250 volts D.C.—2400 amps—1200 R.P.M.—Shunt Wound—Built 1941—No wear shows on commutator.
2—General Motors—Mod. 3-268-A diesel engines direct connected to Delco 100 Kw—3 wire—120/240 volt D.C. generators.

P. A. HENAULT CO.
25167 Grand River Ave., Detroit (19) Mich.

FOR SALE

Ingersoll-Rand Horizontal two stage compressor with 100 H.P. G.E., slip ring motor. 500 C.F.M. Capacity and controls.

UNION BUILDING & CONSTRUCTION CORP.
631 Main Avenue Passaic, New Jersey

TURBO-GENERATORS
AVAILABLE IMMEDIATELY

1—6250 kva 5000 kw 3600 rpm Allis-Chalmers 200 lbs. 100° SH condensing. Will operate 275 lbs. 615° TT without change. Generator 3/60/11500 can be changed to 2400/4160 V. Complete auxiliaries—can be operated for inspection. Checked by factory engineer in September 1951—no repairs required.

1—1875 kva 1500 kw 3600 rpm General Electric 150 lbs. 0° SH condensing. Generator 3/60/2300.

1—1567 kva 1250 kw 3600 rpm Allis-Chalmers 140 lbs. condensing. Will operate 200 lbs. 450° TT without change. Generator 3/60/2300. Complete auxiliaries.

1—1250 kva 1000 kw 3600 rpm Westinghouse 185 lbs. 100° SH condensing. 3/60/2300. Completely reworked, generator has new winding. Complete auxiliaries.

1—937 kva 750 kw 3600 rpm General Electric 150 lbs. condensing. Generator 3/60/2300.

1—625 kva 500 kw DeLaval geared 5000/900 rpm 150 lbs. condensing. Generator 3/60/2300. Can operate 275 kw 10 lbs. BP without change.

1—187½ kva 150 kw Westinghouse geared 7200/900 rpm 150 lbs. 100° SH non-condensing. Generator 3/60/240.

ALSO IN OUR STOCK

COMPENSATORS, A.C. AUTOMATIC
75 hp 3/60/2300 Cutler Hammer Bul. 9622 w/current limit, fuses. New
125 hp 3/60/2200 G.E. CR7051-H1A.

COMPENSATOR, A.C. MANUAL
100 hp 3/60/2200 Westinghouse Type A

CONDENSERS
2—725 sq. ft. C. H. Wheeler 2 pass surface. New

COMPRESSORS, AIR
1200 CFM @ 200 rpm 1-R 1 stage 22"x14"x16" short center belt drive.
1000 CFM @ 225 rpm CP 2 stage 20"x12"x14" short center belt drive.

DIESEL GENERATORS
250 kw 400 rpm 3/60/220-440-2200 Superior YLO

ENGINE GENERATORS
2—65 kva 327 rpm 3/60/220 Engberg 9x10 vertical 175 lbs. non-condensing.

GASOLINE ENGINE GENERATORS
50 kw 1800 rpm 3/60/220 Waukesha-Bardco housed on wheels.

GENERATORS, A.C.
375 kva 225 rpm 3/60/220 Allis-Chalmers engine type
250 kw 400 rpm 3/60/220-440-2300 GE engine type
250 kw 1800 rpm 3/60/2200 Westinghouse ped. brgs.
200 kw 720 rpm 3/60 any voltage GE ped. brgs.

GENERATORS, D.C.
75 kw 1200 rpm 125 V. GE single brg.
20 kw 1200 rpm 125 V. GE CDM

OIL CIRCUIT BREAKERS
600 amp. 15000 V. West. FO221 o/d solenoid oper.
600 amps. 15000 V. Conduit Oil o/d solenoid oper.

MOTORS, SLIP RING
350 hp 360 rpm 3/60/2200 GE Type IM
200 hp 1800 rpm 3/60/2200 GE Type IE 13B
200 hp 1800 rpm 3/60/440 GE Type IM
100 hp 900 rpm 3/60/440 GE Type MTC5346
75 hp 1800 rpm 3/60/2200 Westinghouse C.W.
2— 75 hp 720 rpm 3/60/2200 Westinghouse HF
50 hp 720 rpm 3/60/2200 GE Type MT552
50 hp 900 rpm 3/60/2200 GE Type IM

MOTORS, SQUIRREL CAGE
125 hp 3600 rpm 3/60/2200 GE Type FT
100 hp 1800 rpm 3/60/2200 A-C Type AR
60 hp 1800 rpm 3/60/220-440 F-M Type H
50 hp 720 rpm 3/60/2200 GE Type KT546

MOTORS, SYNCHRONOUS
400 hp 1800 rpm 3/60/2200 Westinghouse ped. brgs.
300 hp 400 rpm 3/60/220-440-2200 GE engine type
90 hp 720 rpm 3/60 any V. GE Type ATI ped. brgs.
100 hp 1200 rpm 3/60/2200 West. dir. conn. exciter

MOTOR-GENERATOR SETS
1000 kw 600 V. 514 rpm Westinghouse 1440 hp any voltage syn. motor

PUMPS, BOILER FEED
750 gpm 450 lbs. 3600 rpm Goulds 3360 4"—4 stage
475 gpm 750 lbs. 3600 rpm Goulds 3360 3"—6 stage
2—150 gpm 230 lbs. 2750 rpm Frederick steam turbine driven

TRANSFORMERS, 60 CYCLES
2—1000 kva 13800/2300 V. 1 Ph. GE Type H Form VDDJ
3—75 kva 2400-4160/240-480 V. 1 Ph. GE Type H Form KF
3—37½ kva 2400-4160/120-240 V. 1 Ph. GE Type H Form K
131—10 kva 2400-4160/120-240 V. 1 Ph. Various Makes—All modern
28—7½ kva 2400-4160 120-240 V. 1 Ph. Various Makes—All modern

TAMPA ARMATURE WORKS INC.
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ELECTRICAL CABLE
- for every Industrial and power application
- Special constructions. Odd lengths.
- Large stocks on hand of high voltage, lead covered cables not ordinarily stocked by your regular suppliers.
- Cut to length. Reasonably priced.

UNIVERSAL WIRE AND CABLE CO.
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AVAILABLE: 1—700 also 470 HP—180 rpm, 4160 volt, 3 phase, 60 cycle UNUSED SYN. MOTOR.
1—1875 KVA G.E. condensing turbine unit. 100 & 150 KW, 440 AC—250 DC M.G. Set.
WANTED: 500 KW 360 or 400 RPM—480/2100 volt horizontal waterwheel generator.

H. BLANE JOHNSON & ASSOC.
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53 W. Jackson Blvd. Chicago 4, Ill.

FOR SALE
One Cochrane Corp., new, never uncrated, #CBA-5 condensate drainage control unit rated to handle 30 G.P.M. at 70 PSI differential pressure including thermometer, two pressure gauges, automatic air relief valve, inlet manifold strainer, integrally mounted differential pressure controller, motor starting switch and 5 H.P., 220 volt, 60 cycle 3 phase motor.

FRED WHITAKER COMPANY
Ridge Avenue & Scott's Lane Philadelphia 29, Pa.

FOR SALE
COMPLETE WOOD DUST—SHAVINGS STOKER
Including approximately 1000 cu. ft. Bin, butterfly valve duct sections, screw feed with sprockets and #4000 Reeves Drive. Could also be used for conveying fertilizer, sand and similar items. Phone or write: **TOMLINSON of HIGH POINT**, North Carolina.

FOR SALE
Three (3) second hand 25,000 barrel cone-roof Storage tanks dismantled and ready to ship. Tanks were previously used for oil storage. Pieces matchmarked for erection. Drawings available.

MISSISSIPPI CHEMICAL CORPORATION
Yazoo City, Mississippi

SQUIRREL CAGE MOTORS—3 Ph., 60 Cy.

Qu.	HP	Mfg.	Volts	Type	Fr.	RPM
1	40	West.	440	CS	854C	4 speeds
2	60	Louis Al.	220/440	TEFC	505	1180
1	60	Woods	220/440	TEFC	72	1200
1	100	West.	440	CS		600
1	100	G.E.	440	KT	356	860
1	125	G.E.	440	KT	547	1860
1	125	West.	2400 (2 PH)	CS	771	1750
2	*150	Al.-Chal.	2300	ARW		1750

SLIP RING MOTORS—3 Ph., 60 Cy.

1	30	G.E.	220	MT	342	690
1	40	G.E.	220	MT	346	690
1	40	**Al.-Chal.	440	B. Brg.		900
1	50	West.	220	CW		1175
1	75	G.E.	220	MT	456	870
1	100	G.E.	220		16	430
1	*250	C.W.	550	BW	68-CS	1800
1	*300	C.W.	550	BW	68-DS	1800
1	*500	C.W.	550	BW	80-BS	1800
1	500	G.E.	2300		17B	900
1	*600	C.W.	550	BW	80-CS	1800
1	600	West.	440	CW	432D15	1800

SYNCHRONOUS MOTORS—3 Ph., 60 Cy. With Direct Connected Exciters

1	75	El. Mach.	220			1200
2	125	**El. Mach.	4800			900
15	135	***G.E.	4000	TS	983Z	1200
1	*200	**El. Mach.	208			1200
1	*300	**El. Mach.	208			1200
1	*350	**El. Mach.	208			1200
1	*400	**El. Mach.	440			1200

DC MOTORS BALL BRG. MARINE TYPE

Qu.	HP	Mfg.	Volts	Type	Fr.	RPM
6	*7½	Rel.	230	T	14T	1750
1	*12	**Rel.	115	T	46T	1300
2 Vert.	30	**Cent.	230	DN	575Y	1750
2	*50	**Cent.	230	DM	454S	2280
2 Winch	42.5	**G.E.	230	CDM	1830AE	525
3 Winch	58	**West.	230	CK	9	600
8	75	***C.W.	230	TEFC	&2M	660
1	75	**Al.-Chal.	230	DEB-1		1150

DC GENERATORS BALL BRG. D.P.

11	25 KW	West.	125	SK	103	1800
7	25 KW	El. Prod.	125			1800
1	30 KW	Burke 1-Brg.	120	WA2	52	1450
2	300 KW	G.E. 1-Brg.	345/290	CY	221	1200

AC GENERATORS 3/60/440/.8 P.F./1800

11	75 KVA	***West	1-Brg.	
7	75 KVA	**El. Prod.	1-Brg.	
1	62.5 KVA	E. M.	2-Brg. 120—208V/900 RPM	
1	125 KVA	G.E.	2 Brg.—50-58/120-208-480V	

DIESEL ENGINES—PUMPS

TURBINE GENERATORS—M-G SETS
2 New Hercules 135 HP Mod. DWXD
250 KVA Elliott Turbo Gen. 3/60 208V/1200 RPM
1—100 KW Cummings AC 3/60/240 V 1800 RPM w/ radiator
1—100 KW Buckeye AC 3/60/2200V/400 RPM
1—200 KW Buckeye AC 3/60/2200V/360 RPM
4—1000 GPM, at 280' head, Buda Diesel Fire Pumps
Worthington Fire Pump—1000 GPM w/100 HP G.E. KT 543 3/60/220V/1800 w/compensator
*NEW—**BALL BEARING—***SEP. EXCITER

210 Snediker Ave.
Brooklyn 7, N.Y.

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FOR SALE
By Denver and Rio Grande Western Railroad Company
1531 Stout St., Denver 1, Colorado
Office of Chief Engineer

1—75 KVA—2400 V. 3 phase, 60 cycle Skinner Uniflow Engine Generator with exciter
1—Panel Board with circuit breaker and voltage regulator
1—250 HP Heine Boiler 160 lb. design
1—Webster open type feed water heater
1—Miscellaneous included valves, pipe and fittings
1—Feed Pump

Purchaser to dismantle and take delivery at Phippsburg, Colorado.

BOILERS
10 to 5000 H.P.
Diesel, Steam Turbine, Engine
GENERATORS
Heavy Power Equipment
Industrial — Chemical Process Equipment
NEW – RECONDITIONED – USED
DEAN G. STRICKLER & ASSOCIATES
1346 Connecticut Avenue, N.W.
Washington 6, D. C. • DuPont 3386

FOR SALE

COMPLETE POWER PLANT

1—**STERLING BOILER—BABCOCK & WILCOX** 100,000 lbs. per hour capacity, 450 lbs. steam temperature—581°F., complete with Westinghouse underfeed stoker and all auxiliaries.

2—**5000 K.W. G.E. Steam Turbine,** 1500 R.P.M. 2300/4400 volts, 3 phase, 25 cycle, with 12,000 sq. ft. condenser and auxiliaries.

1—**300 K.W. Westinghouse Geared Steam Turbine,** with generator, 1500 R.P.M. 2300/4500 volts, 3 phase, 25 cycle, steam end speed 6120/1000 non-condensing.

1—**50 K.W. 125 Volt, 280 R.P.M. Steam Engine Driven Exciter Unit,** with 1—12 x 11 vertical marine engine, speed 280 R.P.M.

1—**400 Amp. 280 R.P.M. G.E. 125 Volt Generator,** Type M.P., Form R.B., Class 6-50-280.

1—**75 K.W. 3300 R.P.M. G.E. Steam Turbine,** direct connected, 125 volt, D.C. generator, with 1—type C.C., Form T, 600 amp., 3300 R.P.M., 120 volt, Class 4-75-3300 Generator.

1—**75 K.W. M/G Set,** 2 unit, 3 bearing, will sell complete or individually. Above units in first class operating condition, complete with controls, panel boards, etc.

WRITE — WIRE — PHONE

• M. S. KAPLAN COMPANY •

231 SO. LA SALLE STREET **CHICAGO 4, ILL.**

FOR SALE
Quantity of Model SGV-700C-11
FAIRCHILD AIRCRAFT ENGINES
12 Cylinder—Inverted Vee-Type—Air Cooled—Geared Drive.
FS-3511, POWER
330 W. 42 St., New York 36, N. Y.

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100 6-71 Twin G.M. Diesels 200 H.P. Complete with generator and starter. All ready for installation. Most run less than 50 hours. Subject to prior sale—principals only.
FS-4245, POWER
330 W. 42 St., New York 36, N. Y.

TURBO GENERATORS
4000 KW. 300# Bleeder type, Surf. Condenser
3000 KW. 425# Non Cond. 60# back pressure
2500-1750 KW. 225#, 5-15# back pressure
2—1250 KW. 125-200# Surf. Cond. Price low
750 KW. 185# Extraction 25#, Condenser

BOILERS
87,000# high eff. Steam Generator, 350#
50,000# 3 drum, bent tube, 225# pressure
3—300 HP. Single drum, Box Header, 170#

ALSO
Generator: 3500 KW. 3/60/2300v. Rewound
Diesel Plant: 3—400 KVA. 440 v. 514 RPM.
STEPHEN A. DOUGLASS CO.
630 Fort Washington Ave., New York 33, N. Y.

WANTED

WANTED
One Steam Turbine Generator
1000 K.W. to 1250 K.W. three-phase 60-cycle, 480 volts. Turbine to have automatic extraction feature to bleed at least 10,000# per hour at 10 PSIG with surface condenser and all auxiliaries. Prefer direct connected exciter and complete control panel. Above unit must be in good condition, not too old, and ready to run.

ALSO WANTED
300 K.W. Non-Condensing Turbine Generator
Designed to run with 10# PSIG back pressure; same electrical characteristics as above. Our steam pressure 175 PSIG. Give full information and cash price in first letter. Write:
E. L. BRUCE CO.
P. O. Box 397 **Memphis 1, Tenn.**

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AC & DC Motors — Generators — Pumps — Transformers — Controllers — Oil & Air Breakers — Axial Fans — Diesel & Turbine Driven Equipment
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210 SNEDIKER AVE., BROOKLYN 7, N. Y.
HYacinth 5-0800

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STRUCTURAL STEEL BUILDINGS
TANKS
BENKART STEEL & SUPPLY COMPANY
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No lengths too long or too short
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New 'SEARCHLIGHT" Advertisements received by June 11th appear in July issue, subject to limitations of space available.
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A number of high-pressure boilers up to 600# pressure and 3000 H.P.

TURBO GENERATORS

1—1000 KW, non-condensing, 15 lb. B.P. 3/60/480 V.
1— 750 KW, non-condensing, 15 lb. B.P. 3/60/480 V.
1— 500 KW, non-condensing, 15 lb. B.P. 3/60/480 V.

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3—150 KVA Westinghouse Transformers OISC, 1 ph., 60 cy., 2300 to 460/230/110, Type SK, Ser. #528371, -2, -3
1—200 HP, 600 RPM, GE. Slipring IM, Frame 17, 3/60/220/440
1—150 HP, 514 RPM, Westinghouse Slip-ring, Type HF, 3/60/220/440
1—100 HP Allis Chalmers, Slipring, Type ARY, BB, 3/60/220/440/900, Frame 826E
3—75 HP, Westinghouse Sq cage motors 3/60/220/440/900 Frame 752C Type CS
1—125 HP, 600 RPM, EM, Synchronous 3/60/2200 type BRKT
1—200 KW MG set, 125 V. DC, 900 RPM Syn. drive, 3/60/2300 E.C. Factory Set.
2—24x24 Dayton Dowd C524, 16,500 GPM, 18.5/35 FT. HD., 360/450 RPM

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GA-4290

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100 KW GENERATOR SET

BUCKEYE DIESEL 400 RPM 3/60/240 with V-Belted exciter, Switchgear, Voltage Regulator, Oil filter, Silencer, Water Pump. Engine overhauled.

Immediate delivery—Priced to Sell

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LIMA, OHIO PHONE 42867

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MOTORS & GENERATORS, etc.
1 YEAR GUARANTEE

Partial Listing Only!

GENERATORS—250 V. D.C.

KW	Make	Type	Speed
500	G.E.	MPC	900
300 (2)	G.E.	CY-272	1200
200	Elliott		1200
250	Cr. Wh.	Syn.	1200
200	Delco		1200
150	West.	SK	900
125 (2)	G.E.	MPC	1200
100	West.	SK	1200
75 (2)	Cr. Wh.		1200
50	West.	SK	900
40	West.	SK	1150
40	ABSee	AVG	1150
30	G.E.	TC32-4	1800
25	G.E.	RC	1150
20	Watton	D	1150
15	Star		1750
10	G.E.	RC	1150
7½	West.	SK	1750

GENERATORS—125 V. D.C.

KW	Make	Type	Speed
150 (2)	West.	SK	1200
100	EL. Mchy.	651-T	1200
100	G.E.	RC	1200
100 (3)	West.	SK	900
100	G.E.	MPC	900
75	G.E.	DLC	1150
60 (2)	West.	SK	1800
50	G.E.	RC	1150
50	Cr. Wh.	CCD	1160

GENERATORS—600 V. D.C.

KW	Make	Type	Speed
600 (4)	G.E.	MPC	1200
325	G.E.	MPC	1200

LOW VOLTAGE D.C.

Amp.	Make	Voltage
10000	J-L	2/10
7500 (2)	Nor.	T⅝
5000	HVW	6
2500	Chandev.	6/12
500	Chandev.	12
1500	Century	24
500	West.	32
1000	Century	32
1000	Chandev.	40
1500	Century	40
1500	G.E.	50
1000	G.E.	60
1000	G.E.	75

MOTORS—230 V. D.C.

H.P.	Make	Type	Speed
187½	G.E.	MDS	435
150	Sprague	LC	1700
100	Al. Ch.		1150
100	F-M	TRC	725
100	G.E.	RC-36	775
90/45 (2)	G.E.	LC-17	950/450
75	Cr. Wh.	CMC-125H	375/950
60	West.	SK	680
60	West.	SK	250/1000
50	G.E.	CD-93	3600
50 (2)	West.	SK	565
50	G.E.	RP	250/1000

FREQUENCY CHANGERS

KVA	Make	Type	Output Frequency
225	G.E.	ATB	150 cy.
150	G.E.	ATB	150 cy.

MOTORS—Squirrel Cage

H.P.	Make	Type	Speed
250	G.E.	KT5/0	1750
200	Wagner	RP-2	1800
200	G.E.	KP	880
200 (2)	Al. Ch.	AR	870
200	G.E.	KG	700
150	Wagner	7½VRN	900
150	West.	CS	600
125	Al. Ch. (5)	AR	1760
125	G.E.	IK	1150
100	G.E.	KT	1800
100	G.E.	IK	1750
100	West.	CS	1750
100 (2)	Al. Ch.	AR	1150
100	G.E.	K	1175
100	West.		870
75 (2)	West.	CS	1750
75	G.E.	KT	900
75	West.	CS	720

MOTORS—Slip Ring

H.P.	Make	Type	Speed
500	Elliott		1180
500 (2)	G.E.	IM	450
400	G.E.	IM	900
400	West.	CW	435
250	G.E.	IM	435
200 (2)	G.E.	IM	1170
200	G.E.	MT	1175
125	West.	CW	1750
100	G.E.	MT	1150
75	Lincoln		1750
75	G.E.	MT	900
75	West.	CW	600
60	G.E.	MT	1720
60	West.	CW	290

MOTORS—Synchronous

H.P.	Make	Speed
475	West.	720
300	G.E.	900
200 (2)	West.	900
200	Burke	900
180	G.E.	900
165	G.E.	1200
150	G.E.	900
150	G.E.	720
75	G.E.	900

Please Send Us Your Inquiries

L. J. LAND, INC.

Established 1910

150 GRAND STREET, NEW YORK 13, N. Y.
CAnal 6-6976

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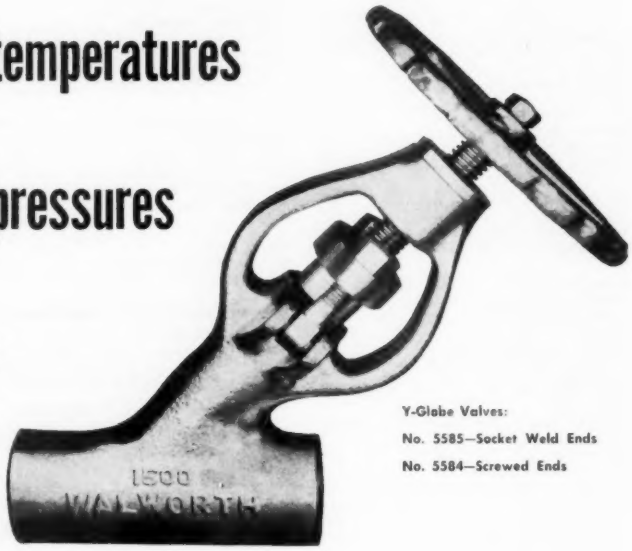
SERIES 1500 – SIZES ¼ to 2 inches

handle { HIGH temperatures / HIGH pressures



Y-Globe Valves:
No. 5585—Socket Weld Ends
No. 5584—Screwed Ends

Walworth is proud to make these new Small Cast Steel Valves available to power stations . . . oil refineries . . . ships . . . wherever piping is subject to severe pressures and temperatures. Non-shock service ratings of these valves: 1500 psi–950F for steam; 3600 psi–100F for water, oil or gas. Cast of chromium molybdenum steel, they are compact and light, yet exceptionally strong. Both Y-Globe and Angle type valves are available.

Angle Valves:
No. 5587—
Socket Weld End
No. 5586—
Screwed End

Simplified Walworth design eliminates many of the valve problems encountered in high pressure service. Among the features of this new valve are:

INTEGRAL BODY AND YOKE — made from a single casting without threading or welding. Bonnet joint — always a potential source of leakage — is eliminated. Valves can be reassembled quickly and easily.

ROTATING DISC – prevents valve seat distortion and consequent leakage. Cuts down replacements.

WELDED SEAT RING – compensates for changes in pressure and temperature—eliminates a major source of leakage.

SPECIAL BACK SEAT BUSHING – permits repacking the valve under pressure with greater safety.

PACKING CHAMBER —designed to dissipate heat thus keeping packing rings at lower temperatures—gives them longer life.

These valves are available with either socket weld ends or screwed ends, in sizes ranging from ¼ to 2 inches. For further information on Walworth series 1500 Small Cast Steel Valves, see your local Walworth distributor, or write for Circular No. 134.

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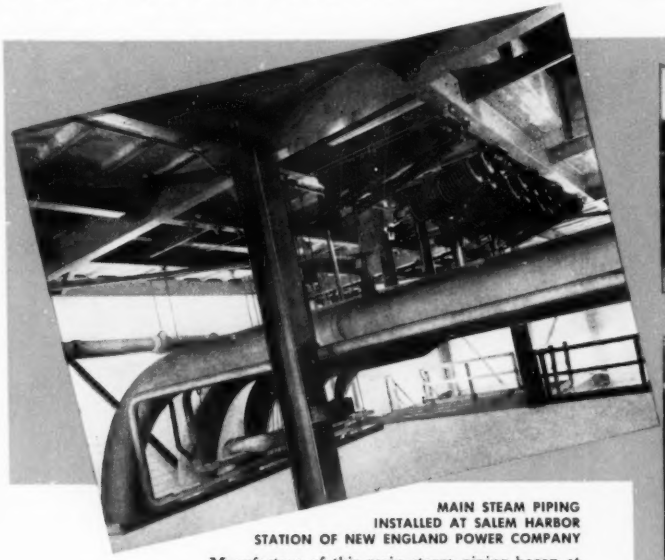
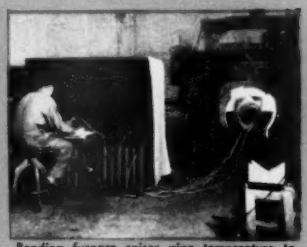


MAIN STEAM PIPING INSTALLED AT SALEM HARBOR STATION OF NEW ENGLAND POWER COMPANY

Manufacture of this main steam piping began at Pennsylvania Forge Corporation as 20-ton alloy-steel ingots (2½% chrome, 1% moly steel). Four days' forging changed the ingots into solid bars 30 ft. long, with outside diameter of 15½ in. Boring, turning, sizing and finishing followed.

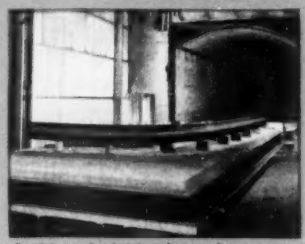
FABRICATION of the main steam line for the Salem Harbor Station of the New England Power Company, vital link in more than 52 miles of piping fabricated by Grinnell, is an example of the *many* skills required of Grinnell piping specialists. Grinnell chemists, metallurgists, physicists, radiologists and supersonic electronic scientists . . . *all* played a part in the bending, welding and testing operations.

The integration of complex, highly technical skills like these into a *single* organization of trained specialists explains Grinnell's leadership in the field of prefabrication. It explains, too, why your interests are best served when you call upon Grinnell's expert personnel and specialized facilities in the solution of your piping problems.

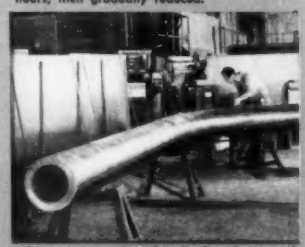


Bending furnace raises pipe temperature to 2000°F in 3 hours, 40 minutes. Thermocouples and pyrometer measure pipe temperature.

Skilled team completes bend in six minutes. Inside surface temperature dropped about 100°F.



Bend being loaded into furnace for stress relieving. Heat maintained at 1425°F for 4½ hours, then gradually reduced.



Ultrasonic inspection of wall after cleaning of pipe shows maximum thinning in bend of 1/16 inch.

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99.99995% PURE WATER

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Reduction of electrolytes to less than 0.2 ppm (specific resistance approximately one million ohms—cm) and silica to less than 0.05 ppm is readily obtainable. In actual practice, specific resistance as high as 24 million ohms—cm has been achieved. Purity of Permutit Mixed Bed Demineralized water exceeds ASTM requirements by over one full decimal place. By comparison, most commercial distilled water contains from 2 to 10 ppm electrolytes. Yet the cost of distillation far exceeds that of Mixed Bed Demineralizing for most normal water supplies, requires more time, and uses equipment that takes up far more valuable space.

**Tentative specifications for Reagent water, ASTM designation D-1193-51T*

In the Mixed Bed Demineralizer, Permutit has developed equipment to produce water with total electrolytes less than 0.2 ppm, silica below 0.05 ppm. It is a single unit ion exchanger containing both anion and cation exchange resins in a homogeneous mixture. In one single stage, many separate demineralizing steps are provided, so that mineral impurities reach the vanishing point. The residual content is so low that conventional methods of analysis cannot be used for accurate determination, and conductivity measurements are customarily used. The types of ion exchangers—both anion and cation—can be varied to meet individual requirements for which the Mixed Bed Demineralizer is used. Through such variation, the Demineralizer can be applied to many different uses. The latest development by Permutit is *fully automatic control!*

For further information, write to The Permutit Company, Department P-6, 330 West 42nd Street, New York 36, N. Y.

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